The Dock and Harbour Authority

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The Port of Bristol.

If any justification be required for the publication of another article on the subject of the Port of Bristol following that which appeared in our issue of September, 1934, it is to be found in the vigorous and enterprising policy pursued by the Port of Bristol Authority over an extended period of recent years, during which the dock accommodation and the quayside cargo-handling and transport facilities at the port have been expanded to such a degree as to be, as stated by Mr. R. H. Jones in his article, even "somewhat in advance of the immediate needs of the port." Such an enlightened and far-sighted policy is surely to be commended and it may confidently be expected that it will reap the reward it deserves. Not only does the proverb "nothing venture, nothing have" counsel bold measures, but experience shows it to be a fact that the provision of adequate facilities tends to promote the growth of trade, assuming, of course, reasonable prospects and the absence of abnormal adverse conditions.

As a port, Bristol is practically unique in this country in being the solitary instance of a first class port under municipal control. It is true that there is another port on the West Coast—Preston—which is municipally administered, but the trade of the Ribble is hardly comparable with the trade of the Avon. At any rate, these two ports lie in a special category: they are the only two examples of this system of port management to be found in Great Britain. It is of further interest to note that Bristol port has reverted to municipal control after a period of independent dock ownership, such as London experienced prior to the formation of the Port of London Authority.

Although adequately fulfilling the needs of the two port districts in question, it is a matter for debate whether, on the whole, municipal governance of port affairs is the best form of control. There is, of course, the undoubted fact that the system enjoys some measure of popularity on the other side of the Atlantic, more particularly in the United States. Indeed, the practice in that country is sufficiently extensive as to constitute a striking argument in its favour. At the same time, this serves to reveal one of its weaknesses, in that municipal politics and port affairs not being necessarily identical, there may be a clash of interests. Indeed, the former may tend to become the governing factor. In America, politics exert an influence in municipal affairs which is even more marked than in Great Britain, and changes in port personnel occur simultaneously with changes in party predominance. Whatever may be thought about this, with its underlying temptation to "graft" and political intrigue, Bristol, in this country, stands out as a striking example of capable and efficient municipal port administration.

The Dock and Harbour Authorities' Association.

At the annual meeting of the Dock and Harbour Authorities' Association on February 10th, Colonel Beazley, chairman of the Executive Committee of the Association, in a carefully reasoned address, laid before his hearers two matters of vital importance to the interests they represented.

First, he referred to the Government White Paper (Cmd. 6403) issued in November last (the essential terms of which were given in the December issue of this Journal), in fulfilment of the promise of the Board of Trade to introduce a supplementary Bill dealing with the application of the War Damage Act, 1941, to public utility undertakings, including docks and harbours, and pointed out the disproportionate incidence of the 50 per cent. contribution ratio on the latter, since these had been the particular object of air attack and were therefore subject to a heavier burden of war damage than other undertakings. In the opinion of the Executive Committee, the 50 per cent. ratio was far too high and the procedure for obtaining a modification, under the special circumstances, unnecessarily complicated. Accordingly, it had been decided to ask the Parliamentary chairman to take the matter up and, at a later date, if necessary, to request the Chancellor of the Exchequer to receive a deputation on the subject. The contention of the Association is so reasonable and well-founded that it should unquestionably receive the sympathetic consideration of the Government.

The second point in Col. Beazley's address is of momentous importance to the whole body of port authorities throughout the country. He stated that the Executive Committe had been informed that certain officials of the Ministry of War Transport had had under consideration schemes for the reconstitution of dock and harbour authorities, possibly one scheme on the lines of a single corporate body for the entire kingdom, following the examples of the B.B.C., the Central Electricity Board and the London Passenger Transport Board. The idea of centralisation is, no doubt, attractive to the authorities in Berkeley Square, as to other Government officials, but we venture to point out that the analogies in question do not quite hold good in port affairs, or in common parlance, they are "not

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on all fours." The corporations mentioned are concerned with matters of a homogeneous nature and uniform application. The dissemination of news and entertainment programmes by the B.B.C. is of the same purport and kind whether received at Newcastle or Plymouth. Electricity is an invariable medium whether dispensed at Kidderminster or Cathay, and the London Passenger Transport Board, while it handles both rail and road traffic, does so in an environment which is uniformly similar.

Now port trade, and consequently port operation, are very diverse in character: both are extremely varied. Scarcely two ports bear any resemblance to one another in the nature, scope and peculiarities of their commerce. The trade of the Port of London is altogether different, not only in kind, but also in method of operation from that of the Port of Cardiff. The Humber and the Mersey are not more dis-similar physically than commercially are the ports on their banks. Everywhere are to be found local practices and customs—idiosyncracies which cannot be reconciled with those elsewhere. Each port, or at least, each unitary group in a locality, calls for distinctive treatment. The Bed of Procrustes could hardly be a greater incongruity than an attempt to force all port trade into a single administrative groove.

It seems to us that at the present time, under the influence of the heady wine of post-war reconstruction, the nation is suffering from a surfeit of well-meant, but, sometimes misguided centralisation scheming. Within certain limits the process is desirable and serviceable, but if extended too far, it is likely to break down through overloaded organisation. Much more might be said on the point, but it can hardly be developed in this Editorial Comment, which is already sufficiently lengthy. We must reserve the topic for a subsequent occasion.

Meanwhile, Col. Beazley's address will be found in full in a later page.

Sea Walls.

In an insular country, with an extensive coastline exposed to the violent ravages of storm and tempest and to the no less destructive, though more insidious, effects of marine erosion, the protection of the sea frontage should be deemed a matter of paramount importance. Unfortunately, so far as Great Britain is concerned, this is not the case, though every year witnesses fresh incursions of the sea attended by huge downfall of cliffs and submergence of valuable land; nor is there any serious or systematic attempt made to arrest the process or to provide adequate counter measures. We have dealt with the subject at length on previous occasions and only allude to it again by way of introduction to an article in this issue on the design and construction of sea walls.

Sea Walls are a form of coast protection, which, if properly constructed, has the merits of stability and permanence. It is possible, of course, to control to some extent the denudation of beaches and the undermining of friable cliffs by means of groynes, and numbers of these are in existence with beneficial results at various points along the coast line, but walls of suitable design are a much more reliable and efficient protection, though necessarily at considerably enhanced cost. Much depends on the value of the land to be protected and it would scarcely be a sound economical proposition to construct substantial walling along extensive frontages of merely agricultural land and open pasturage; but in the vicinity of seaside resorts and populous localities, walls are undoubtedly essential to the safety and security of the inhabitants. Only by means of massive and solid structures can effective resistance be opposed to the tremendous onslaughts of sea waves, the titan-like blows of which would speedily demolish less substantial works. In this respect, sea walls are akin to harbour breakwaters and the same principles are applicable to their construction, with such modification as may be due to the support they receive from the land in their rear.

The article by Mr. C. E. Fellows in this issue will be read with interest by those of our readers who are concerned with the preservation of the coast line and specially of such portions as are contiguous with urban districts.

British Shipping Policy.

Port Authorities are hardly likely to be indifferent to the considered opinions of so influential and representative a body as the General Council of British Shipping, and those individual members of a port administration, who are themselves shipowners, will necessarily acquaint themselves with the terms of the report on a post-war policy for British Shipping which has recently been issued by the Council.

On the main body of the conclusions arrived at in the report, couched as they are in general terms, there is no occasion for us to comment, since they concern in a quasi-domestic capacity, questions which lie essentially and solely within the province of shipowners. It is to be noted, however, that the Council take a strong line in favour of "a large and vigorous British marine" which, they aver, is essential to British economy and in accord with British tradition, and they urge that, following a temporary "relief period," in which the evils engendered by the war will require rectification, there should be "a progressive liberation of shipping coupled with the establishment of effective co-operative machinery in the industry to ensure satisfactory service and to maintain freight markets at a reasonable level." In simpler phraseology, shipowners want reasonable freedom of action.

With regard to practical problems having a bearing on port accommodation, the Council call attention, *inter alia*, to the effect of air transport on shipping. Uncertainty as to the rôle of air will act, they say, as a deterrent to fresh construction of passenger ships until Government policy in regard to air is known. They confirm an opinion expressed in one of last month's Comments by adding: "It is probable that given sufficient financial support from governments as a matter of national policy, much high-class traffic, previously sea-borne, can be diverted to air. If this were to be the Governmental policy, then the passenger ship will tend to disappear—a development which cannot be allowed to proceed too far, if reasons of national or international security require the existence of fast ships convertible to trooping."

Accordingly a policy of co-ordination and collaboration "between air and sea" is recommended in place of "out and out competition." A special committee of the Council is, in fact, engaged in formulating a constructive policy for the co-ordination of sea and air transport. This is, undoubtedly, a judicious attitude which should command the approval not only of the Government, but also of shipping and air concerns generally.

Port Labour Grievances.

Echoes of port labour troubles continue to be heard.

In the House of Commons on February 17th, a question by Squadron-Leader Errington about the findings of the Forster investigation into working conditions at the Liverpool Docks elicited the following written reply from Mr. Noel-Baker, Parliamentary Secretary to the Ministry of War Transport.

"After consultation with the Minister of Labour and National Service, the Minister of War Transport has decided that it would not be in the public interest to publish the report or the recommendations made by Sir John Forster. Instructions based on the recommendations have been given to the Regional Port Director and he is acting accordingly. I am grateful for this opportunity of expressing the gratitude of His Majesty's Government to Sir John Forster for the valuable service he has rendered by his report."

In London, matters which have led to some agitation among dock labourers in regard to the transfer of workers to other ports, are stated to be under consideration by the National Joint Council. The questions are said to relate to the removal of certain alleged anomalies and the provision of a guaranteed full weekly wage for men who are transferred to another port but who, owing to the shipping position are unable to find employment. A deputation, representing the men, made an incursion into the House of Commons on February 2nd to interview Labour members on the subject.

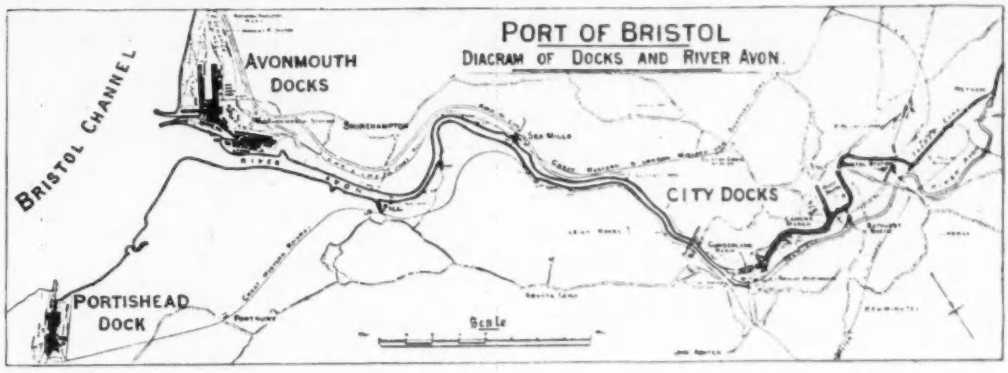
"Sea-going Hydraulic Hopper Dredgers."

For the information of our American readers, it should have been explained that the term "Dredge" as it originally appeared in Col. Vaughan's article (reproduced in recent issues), had been editorially altered to "Dredger," this being in accordance with British terminology, which, with the English system of spelling, is naturally adopted in this Journal.

The Port of Bristol

Past History and Present Prospects

By R. H. JONES, O.B.E., M.Inst.T.
General Manager, Port of Bristol Authority



"The Gateway of the West"

FROM time immemorial Bristol has claimed the proud title of the Gateway of the West, and history justifies the claim. The origin of the City is lost in antiquity, but it is clear that the Phœnicians traded with the western shores of this island long before the Roman conquest, bringing salt, earthenware, and brazen vessels in exchange for tin and lead. The Avon appears to have been the terminal port and the mart for exchange with the Siluri or people of South Wales. The ensuing decline of Phœnician maritime power coincident with the Roman invasion put an end to this trade, but a revival followed as the power of Rome extended, and Bristol was constituted the main Roman outpost in the West.

Bristol prospered through the times of the early Saxon kings, to fall into decay with the Danish conquest of Wessex. For several centuries, however, following the accession of Alfred the Great, she flourished and was, next to London, the principal seaport of England. In A.D. 960 she contributed many ships and men towards the fleet raised by Egbert against the Danes. A charter, dated 1272, is still extant, in which Henry III granted Dublin to be inhabited by the men of Bristol who had long carried on a commerce with Ireland.

Mr. R. H. JONES, O.B.E., M.Inst.T.
General Manager, Port of Bristol Authority.

Edward III in 1347 raised a fleet for the siege of Calais, for which London provided 25 ships and 662 mariners, Bristol 22 ships and 608 mariners, and Weymouth 20 ships and 264 men. No other of the great ports of the present day found a place in the list. Another example of the relative importance of the cities of those distant days is found in a list, dated 1378, of loans to the King. In this list London is shown as contributing £5,000, Bristol the odd amount of £666 13s. 4d. and Salisbury £100. There exists a record that, in 1332, Bristol had an extensive trade with Genoa, Spain and France, Flanders and Norway, the principal exports being grain, tin, and wool.

Epoch of Great Maritime Adventure.

The great period of maritime adventure which began in the sixteenth century with the discovery of America found those great pioneers John and Sebastian Cabot, James Elliot and Thomas Ashurst in the vanguard. They and the Bristol merchants were inured by generations of arduous and successful endeavour to play the part which has added lustre to the great traditions of the City. It is unnecessary to refer in detail to the controversy whether Columbus or the Cabots first actually discovered the mainland of America, but it is not generally known that Sebastian Cabot was chiefly instrumental in founding an extensive trade with Russia by virtue of voyages to Archangel under his auspices. The Cabots also laid the foundation of the West Indian trade, which records show was firmly established in 1526. Soon afterwards, largely by the enterprise of that great philanthropist, Edward Colston, the trade with Spain and Portugal was developed, with later extensions to the West Coast of Africa.

Thus in the eighteenth century we find three trades with different parts of the world mutually complementary and supporting each other. Wines from Spain and palm oil and slaves from Africa were brought to Bristol, where they were marketed and provided back loading for the ships which brought sugar from Jamaica and tobacco from Virginia. It seems clear that Bristol's comparative prosperity at this period was dependent upon her entrepôt trade—the exchange of commodities between those different parts of the world.

One aspect of Bristol's trade, apart from the mere shipping and unshipping of goods, demands attention. In those days inland communication was slow and costly, and so it came about that raw materials had to be worked up on the spot, and hence arose sugar refineries, soap works, cloth mills, pottery and glass manufactories and other factories for the utilisation of imported and home-grown raw materials. The legislation of those days was very monopolistic. Outsiders were not allowed to trade, and to be a burgher or a freeman of Bristol carried with it many material advantages. These rich merchants seem to have combined with their monopoly a great local patriotism. They lived on their work, they established their factories under their own eyes, and they employed the native population. So Bristol waxed rich and grew in population upon a prosperity based almost entirely upon the ocean trade of her port.

Era of Industrial Revolution

The advent of the industrial revolution early in the nineteenth century marked the beginning of Bristol's decline from the proud position of second port and second most populous city in the Kingdom. The invention of the steam engine and the discovery of coal in the northern counties resulted in the migration of a large proportion of the population from Southern to Northern England. Some writers have attributed the decline of Bristol at this stage to the rise of Liverpool, but it may be said that the advance of Liverpool was the consequence, and not the cause, of the rapidly increasing population round it. It may also be said with equal truth that Bristol had the same advantages as Lancashire in available supplies of coal in Somerset and South Wales, with a woollen trade long established, besides a well-developed shipping connection with American ports. Be that as it may, the decline was most

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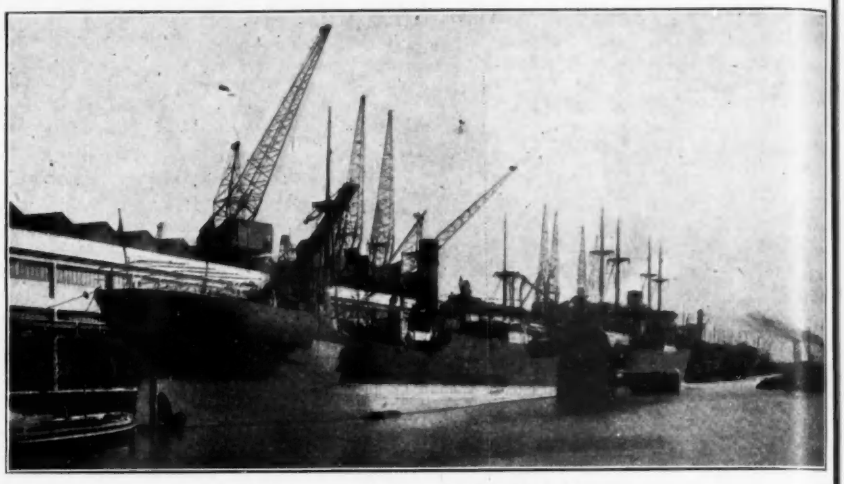
probably due to the apathy of her captains of industry who, with wealth accumulated from trades built up by their progenitors, had settled into a groove. They seem to have failed to see the signs of the times, or to grasp the necessity of altering their methods before the trade had already drifted from them. In the meantime their younger rivals in the North seized on and developed the new channels of trade. Some West Country readers may be inclined to view this trend of affairs with complacency, or even satisfaction, for the West Countryman may be forgiven for his pride in the sylvan beauty of the Western shires. Here Nature has conspired to give the fertile hills and valleys of Somerset and Gloucester a wealth of loveliness scarcely equalled in these islands. There may be, therefore, consolation in the thought that the spoliation inseparable from industrialisation has left the West County practically unscathed.



A busy scene in Royal Edward Dock.

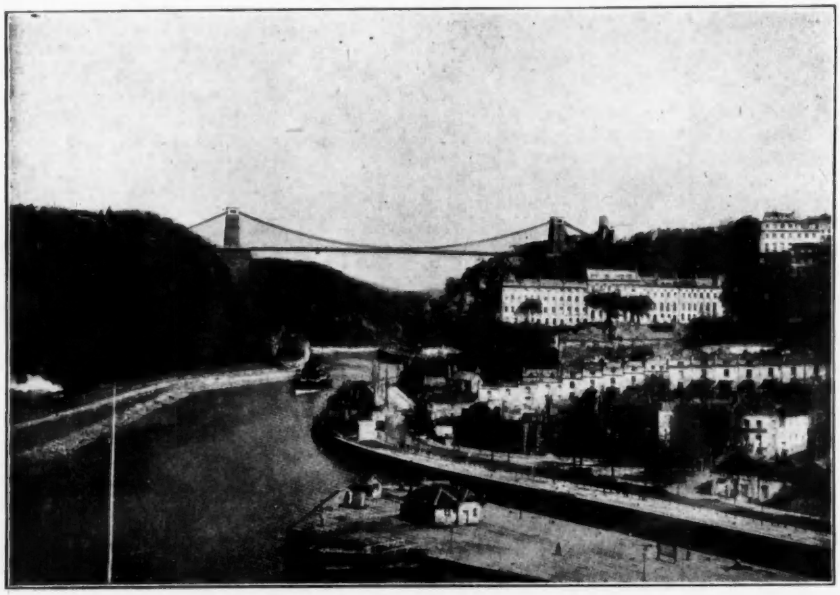
Works of Improvement

It was doubtless the geographical position of the City that first led trade to concentrate on Bristol. It is also probable that the ford of the Severn Estuary at Aust was the scene of the earliest trade relations between the Roman and the Cymri, which later moved to the more secure location afforded by Bristol six miles up the tortuous Riven Avon. Here a certain immunity from the ravages of pirates and sea robbers was obtained. The harbour of those far-off times was mainly as Nature made it, and it is clear that for centuries vessels took the ground with each receding tide, without suffering harm or undue inconvenience. As the science of shipbuilding advanced, however, it became imperative that some improvement on Nature's handiwork should be provided.

The first notice we find of any artificial work was in 1239, and between that date and 1247 the St. Augustine Trench was constructed. This comprised a diversion of the River Frome, and provided a deep water channel for the ships and a quay at which they could lie. It was nearly half-a-mile long and cost £5,000, a formidable sum in those days.

For the next five centuries there exists no record of any important constructional changes. In 1712 a dock was begun at Sea Mills, half way to the mouth of the Avon, at the outfall of the River Trym. It was the third wet dock constructed in England, and is believed to have been for the accommodation of the whaling fleet which was a regular feature of the trade in those days. It was not a commercial success and was eventually abandoned.

The first wet dock is heard of in 1762, when the Merchants' Dock was fitted with gates to impound the water, but apart from this the port for some years remained a tidal one. It became apparent in the second half of the eighteenth century, as it did over one hundred years later, that bold action was necessary if the port was to retain its pride of place. The design of ships was altering, and they could no longer take the ground without damage. There was also serious risk of fire with ships immovable at low tide. Henceforward many schemes for the provision of wet docks were propounded, each to be rejected until at long last, in 1803, an Act was obtained constituting the Bristol Dock Company with a capital of £250,000, increased by subsequent Acts to £580,000. The approved plan provided for the diversion of the River Avon to a new cut from Netham to Rownham. Dams were constructed across the river at Totterdown, near Rownham, and at Netham. Between Totterdown and Netham a straight cut was made, saving three-fifths of a mile. This cut, known as Feeder Canal, enables small craft from above Netham to enter the Float-Harbour at Totterdown, besides supplying the harbour with water to compensate for loss by leakage or in the use of locks, etc.



Clifton Suspension Bridge and Entrance to City Docks.

On the new course of the river, midway between Totterdown and Rownham, Bathurst Basin was made. The principal entrance was formed lower down at Rownham, with entrance locks 189-ft. long by 45-ft. wide and a basin, now known as Cumberland Basin, 700-ft. long by 300-ft. wide connected with the Floating Harbour by means of a junction lock. These works were completed in 1809.

The increase in the size of ships gave rise to further extensions of locks in 1839 to the design of Isambard K. Brunel, the great engineer. The lock dimensions were now 262-ft. by 54-ft. wide, but, in 1865, the necessity again arose and the locks were enlarged to 350-ft. long by 62-ft. wide. At the same time, various improvements to the river enabled ships with a maximum length of 240-ft. to navigate it on favourable tide conditions. This probably marked the limit to which at economic expenditure, the approaches to the City Docks could at that time be improved. About the same date, the rails of the Great Western Railway were extended to the docks.

History repeated itself, and in the latter part of the nineteenth century the City found itself in danger of losing its commerce from the con-

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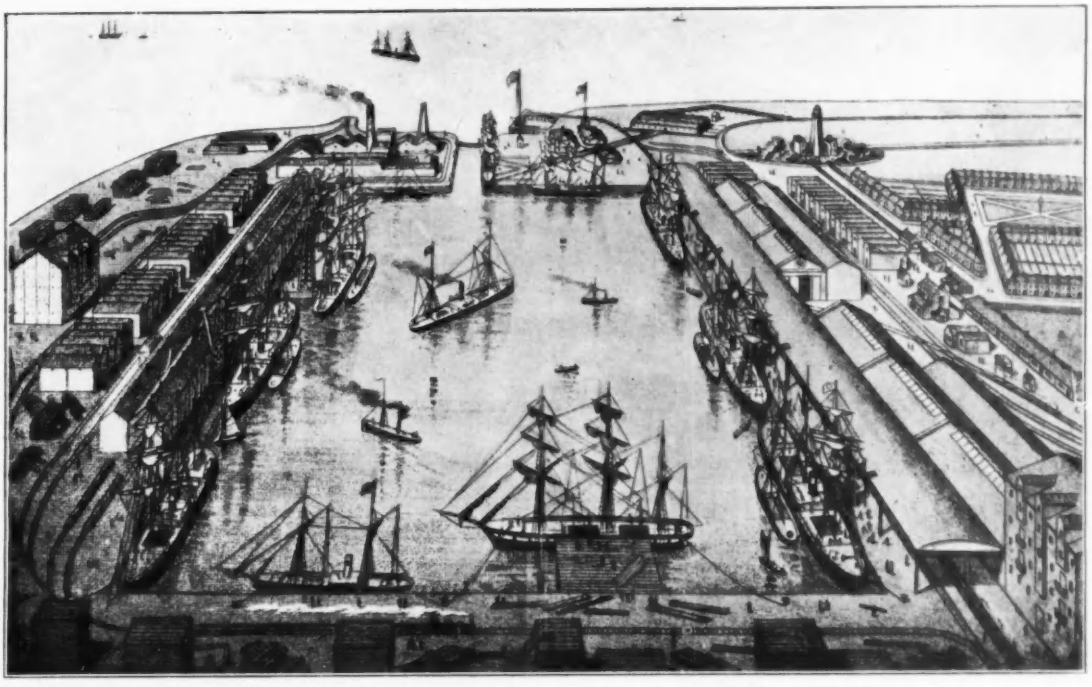
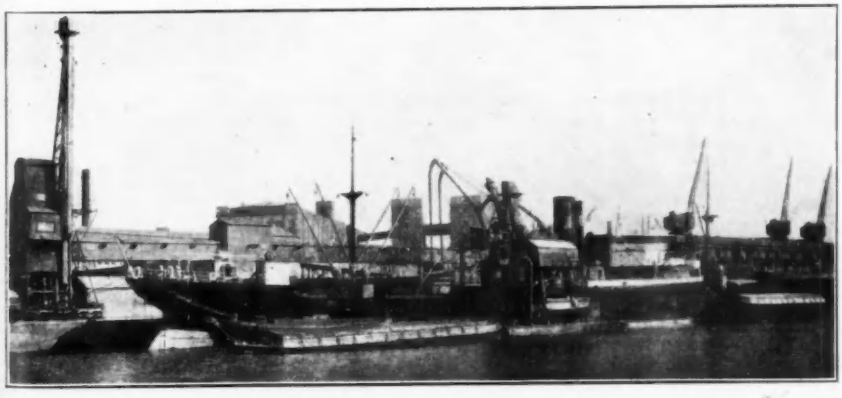


Avonmouth Dock as taken over by the Corporation in 1884.

tinuing growth of vessels too large to ascend the river. Was the needed accommodation to be provided in the river or in entirely new docks outside the river? It would need very much more than the space available to describe even briefly the controversy which raged for forty years between the "dockisers" and the opposite party. The "dockisers" produced successive schemes by eminent engineers to dam the Avon at its mouth or at some intermediate point, and their opponents favoured the construction of docks entered direct from the Bristol Channel.

The practical result of the long delay occasioned by these differences of opinion was that two independent companies were formed for constructing docks at the mouth of the river, one on the Gloucestershire side by the Avonmouth Dock Company and the other by a competing company at Portishead. The Avonmouth Dock was opened in 1877 and that at Portishead two years later. When these two companies commenced business the dockisation controversy was still raging, and it continued after both river-mouth docks were acquired by the Corporation in 1884.

Finally, the Corporation decided to abandon the idea of dockisation and concentrated on the development of Avonmouth. The Council in 1901 approved a scheme drawn up by Sir J. Wolfe Barry and Sir Benjamin Baker, and Parliamentary powers were obtained. On March 5th, 1902, the first sod was cut by the Prince of Wales, and on July 9th, 1908, the Royal Edward Dock was declared open by King Edward. The latest development is the extension of the Eastern Arm, opened by the Prince of Wales on May 23rd, 1928, an addition to the port's already considerable accommodation which is chiefly remarkable for the elaborate facilities provided for the reception and rapid distribution of grain cargoes. Indeed, it may be said that Bristol has completely reversed the disability of unpreparedness from which she suffered for so many years, and is now equipped, on the most up-to-date lines, somewhat in advance of the immediate needs of the port.



Floating Elevator at work in Royal Edward Dock. Two of the Granaries in the background.

Administration

The history of the administration of the Port of Bristol differs from that of any other port in the country, for while other ports have mostly undergone a devolution from corporate ownership to private enterprise, Bristol alone after lengthy trials of both systems has reverted to the earlier, and remains to this day under the fostering care of the citizens.

A charter granted by King John in 1190, which seems to have succeeded earlier ones, conferred the right to burgesses to traffic in the commodities which formed the trade of those days. This was repeated in many subsequent patents and grants. The ground for St. Augustine's Trench, already mentioned as being the first artificial work, was purchased by the City from the Abbot of St. Augustine. There are records in the reigns of Henry III and the first two Edwards of grants enabling the City authorities to collect tolls on ships. The first authority to collect dues on goods was granted by Edward III. In the first year of his reign Edward IV granted the right to levy tolls in perpetuity to the Mayor and Commonalty of Bristol. In 1500 Henry VII appointed Thomas Hoskins to be Water Bailiff for life, and granted to the Mayor and Commonalty to appoint his successors on payment of four marks a year to the King. The holder of this

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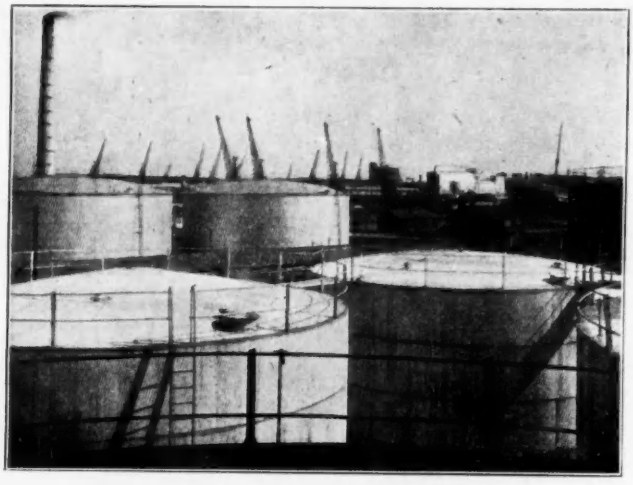
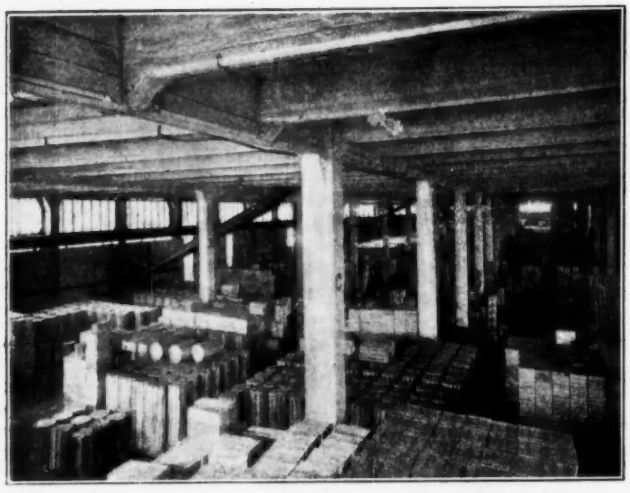


Some of the Oil Tanks at Royal Edward Dock.

picturesque office, which is still retained, was, until after the constitution of the Dock Company, the chief officer of the Corporation in control of shipping. The charges levied on trade from about that time were collected under the heads of Anchorage Dues, Moorage Dues, Mayor Dues on ships, and Wharfage Rates on goods. These dues are now absorbed in the single port due on ships and goods, but a dissection is still made at the Docks Office, and the proportions based on the old schedules are paid over to the City Treasurer for credit to the general revenues of the City.

What might appear to many to have been an anomalous position was the disposal by the Corporation of these perpetual powers to the Society of Merchant Venturers for a nominal payment of £10 a year. Much bitter criticism was excited in the years that followed by what was termed the exploitation of the City by the Merchant Venturers, but the facts appear to be that the Merchants Societies and the City Authorities were identical, and the Merchants Guild was the department of the town administration whose duty was to maintain and regulate the trade monopoly. During the sixteenth and seventeenth centuries various long-term leases were granted by the Corporation to the Society of Merchant Venturers, which conferred upon them the right to collect dues on shipping, they in turn being responsible for the provision and maintenance of the quays. The Society's last lease was surrendered in 1861. It was this leasehold possession which gave the Merchants Society an equal interest with the Corporation itself when agitation resulted in the establishment of the Bristol Dock Company in 1803, and under the Act of that year, the Board of Directors consisted of nine members of the Corporation, nine members of the Merchants Society, and nine representatives of the shareholders. The Act preserved all rights of the Corporation, and provided a schedule of charges on ships and goods to be payable to the Company, with a sinking fund which should eventually redeem the capital, when the whole concern reverted to the Corporation. The division of interests in this peculiarly constituted Board led to recriminations, and disaster was the result of divided management. It was left to the Corporation in 1848 to obtain Parliamentary powers to acquire all interest in the Company on the terms of paying shareholders $2\frac{5}{8}$ per cent. on their stock. Finally, in 1883, the Dock Company was dissolved.



Interior of one of the Transit Sheds at Royal Edward Dock.

While the City was discussing various policies for the improvement of the port's facilities, the private companies which had constructed docks at Avonmouth and Portishead, as already explained, were taking a growing proportion of the total trade, and the ensuing rate-cutting war between the separate interests culminated in 1884 when both companies were brought out by the Corporation. From then until 1900 the dockisation controversy effectually held up extensions, the need for which was recognised by all parties. In 1900 the Corporation agreed upon a policy of extension at Avonmouth, and the Royal Edward Dock was constructed. It is inevitable in view of the tendency of shipbuilding that Avonmouth should take an increasing proportion of the trade of the port, but that does not mean that the trade of the City Docks has declined. On the contrary, there has been a steady increase of tonnage. The City Docks deal principally with the coasting and short sea trades, while the ocean trade is mostly accommodated at the river-mouth.

Wine Bond, Royal Edward Dock, Avonmouth.

Trade and Future Development

It will be apparent to students of transport that much of Bristol's distributive power and success as a port is due to her geographical position. To illustrate this point it is only necessary to state that within a radius of 100 miles is a population of over 12 millions, or one-fifth of the population of Great Britain. The greater part of this hinterland lies within the port's economic zone, including the great industrial West Midlands with Birmingham at its centre.

The value of the progressive policy followed by the Port Authority in providing up-to-date dock accommodation has been shown by the steady development of the trade during the present century. Old and well-established trades have been stimulated and new ones fostered. Fish trade routes have been encouraged by means of an active commercial policy based upon the Port's exceptional distributive power. It is in this respect that the Port of Bristol probably makes its greatest appeal with the advantages of dual rail connection by lines of the Great Western Railway Com-

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pany and London, Midland and Scottish Railway Company, supplemented by an effective waterway to the Midlands. There is also the further asset of regular coastwise services for goods in transit to and from other ports and a network of roads radiating in every direction. Traders, therefore, have the choice of the several methods of transport in supplying the needs of an area comprising the West of England, the whole of South Wales, the Midlands and a great part of the South of England.

The Port Authority is rendering every possible assistance in the development of new industries in the vicinity of the port and in pursuance of this policy a large area of land has been acquired in close proximity to the Avonmouth Docks. This offers excellent opportunities to manufacturers requiring ready access to sea routes and with the attendant advantages of cheap reception of raw materials and conveyance of manufactured articles, advantages which are further strengthened by the geographical position of the port situated as it is far up the Severn Estuary.

Notwithstanding the already great trade which the Port enjoys the Port Authority is fully alive to the need of still further trade expansion, and in enlarging and equipping the docks in the manner described it has displayed an optimism which compels admiration. Bristol certainly appears to have commenced the long climb back to her former eminence among the great ports of the country.

Sounding for Seaweed

Novel Use of Echo-Sounder

The Ministry of Supply has recently found a new job for scientists, whereby certain salts and chemicals contained in seaweed can be utilised in a vital part of the war effort. Four Cambridge scientists have recently completed an eight months' "seaweed tour" of the British coast to report on the crop that is available.

Writing, with an electric pencil, on the chart of an Echo Sounder.

The answer to "How do they locate the seaweed?" is to be found in the ingenious marine instrument known as the Echo-Sounder, which has been described in previous issues of this Journal. This machine charts the contour of the sea bed with such accuracy and sensitivity that it can trace the location of fish or seaweed to within a few inches and can sound up to 12 miles. After location, special "grabs" are thrown overboard to get samples of the seaweed.

It is of interest to recall the first innovation of a sounding machine was due to Lord Kelvin, in 1872, just after his successful experiments with the Transatlantic Cable.

Not until the last Great War was the echo-sounded experimented with, and now again war has brought into prominence its invaluable aid to navigation. Since 1926 echo-sounders have recorded every conceivable kind of submarine obstruction—wrecks, shoals, reefs, peak formations, the presence of fish—and now seaweed. The wreck of the *Lusitania* was recorded by the echo-sounder lying 308-ft. deep off the S.W. Coast of Ireland. Many famous Survey ships have been fitted with echo-sounders, and among them the new American Survey ship, *Pathfinder II*, launched last January, at Houghton, Washington. In war-time, small coastal vessels find echo-sounders a great help in the difficult navigation involved: many will be acquainted with the colliers of London River—known to watermen as "flat-irons"—these have recently been fitted with the sounding instrument which gives confidence to the helmsman.

Obituary

Former Vice-Chairman of the P.L.A.

The death in his 82nd year is announced of **Mr. Charles Frederick Leach,** chairman of the Dover Navigation Company, Ltd., and a former vice-chairman of the Port of London Authority.

As a member of the firm of C. F. Leach and Co., Ltd., the owners of Mark Brown's Wharf, which was in their occupation for over 70 years until it was taken over in 1929 by the proprietors of Hay's Wharf, Ltd.. Mr. Leach had a connection with the Port of London dating back to 1880. He became a member of the Port Authority on its inauguration in 1909 and was vice-chairman from 1925 to 1934. From 1912 to 1917 he was chairman of the Staff Committee; from 1925 to 1930, chairman of the Maintenance Committee and he had also been chairman of the River Committee. He was a member of the Advisory Committee, which reported on the Charing Cross Bridge scheme, and also of the Donald MacLean Committee on Port Labour. On retirement from the position of vice-chairman of the Port Authority, Mr. Leach was the recipient of a silver salver from his fellow-members as a mark of their esteem for his public services.

Mr. Leach was an underwriting member of Lloyd's and a member of the Baltic Exchange.

Cargo-handling at a Tyne Dock.

Submitting the report of the Docks and Trade Committee to the Tyne Improvement Commission, the chairman, Mr. R. S. Dalgliesh, called attention to the expeditious handling of general merchandise at one of the most important docks on the river, which, he said, compared favourably with other ports in the United Kingdom. Apart from a stoppage some months ago when several hundred dock workers ceased work on account of a dispute over rates of pay and conditions, work on the Tyne had gone on satisfactorily and steadily, about the only trouble experienced being in respect of the transfer of labour to other ports. Local dock labour has complained on one or two occasions that billeting conditions were unsatisfactory, and in one case refused to work and returned home. It is considered in the district that greater success would attend transfers if the habits and customs of the men were better recognised and opportunity given for transferees to share to the full in the more remunerative work.

Notes of the Month

Institution of Mechanical Engineers.

Emeritus Professor F. C. Lea, O.B.E., D.Sc., Wh.Sc., formerly Professor of Engineering at Sheffield University, has been elected President of the Institution of Mechanical Engineers.

Paignton Harbour Dues.

The collection of harbour dues, as well as rents, has been taken over from the Paignton Harbour Company by the Harbour Committee of the Paignton Urban Council.

Projected Italian Ship Canal.

According to a Swedish report, the Italian Government is contemplating the constitution of a canal, wide enough and deep enough to take ocean vessels, from the Mediterranean to Rome, a distance of 6 miles.

Dry Dock Construction in the United States.

The United States Congress has considered and approved the expenditure of 210 million dollars on a programme of dry dock construction to provide ship repairing facilities for the United Nations.

Proposed Additional Fishing Facilities at Scottish Harbour.

Additional facilities for the fishing fleet at Newhaven (Leith), are contemplated immediately after the war. It is announced that plans had been submitted to the Leith Harbour Commission which would allow of developments being carried out within the area of the recently completed breakwater.

Greenock Harbour Order.

Petitions have been deposited at the Scottish Office by the Chamber of Shipping, the London, Midland and Scottish Railway Co., London and North-Eastern Railway Co., and the Caledonian Steam Packet Co., Ltd., praying to be heard against the proposed Greenock Port and Harbour Provision Order, the scope of which was indicated on p. 205 of the January, 1943 issue of this Journal.

Facilities for Aircraft at Port of Glasgow.

As foreshadowed in the February issue, the following motion by the Chairman of the Clyde Navigation Trust was submitted at a meeting of the Trust on 2nd February and unanimously approved. "That the General Purposes Committee of this Trust consider and report to the Trustees, after consulting with Local Authorities and other bodies interested, upon the subject of the provision of facilities for aircraft within the undertaking of the Trust or upon land or waters to be acquired by the Trust if so resolved, and subject to obtaining any requisite statutory power."

Blyth Harbour Commission.

At the recent annual meeting of the Blyth Harbour Commission, Colonel N. I. Wright was re-elected chairman of the Commission and Mr. A. S. Witherington, deputy chairman. In commenting on the general manager's report, Col. Wright said that during the past year the Commission had been faced with many problems. Trade had continued to suffer as a result of war-time conditions, and they were faced with increasing labour costs and rising prices. Despite this, however, the Commissioners had been able to avoid any increase in port charges, which remained at pre-war level.

Dock Labour Scheme for Ayrshire Ports.

Details which have been published of the Dock Labour Scheme for Ayrshire ports under the Essential Work (Dock Labour) Order, 1941, show that the ports covered by the scheme are Ardrossan, Troon, Irvine and Ayr. The scheme is on the same lines as those already in operation at other ports in the United Kingdom. The chairman of the Ayrshire Ports Dock Labour Board is Mr. H. Hopperton, general manager of the Port of Ardrossan. The committee consists of Messrs. Hugh Breen, William Elliott, D. Fullerton, Wm. McGillivray, R. Marshall and John Ross. The area manager is Mr. D. C. Dow at The Harbour, Ardrossan.

Skagen Port Works.

Important extension works contemplated for the Port of Skagen, Denmark, and estimated to cost about 7 million kroner, have had to be deferred on account of the shortage in the supply of cement.

Newcastle Trinity House.

Captain John G. Hardy has been elected Master of Newcastle Trinity House. He has the unusual distinction of holding the position for the fourth time in a period of 28 years.

Dublin Port and Docks Board.

Mr. Thomas O'Connor has been unanimously elected chairman of the Dublin Port and Docks Board in succession to Mr. Percy McGrath. Mr. O'Connor has occupied the position of vice-chairman for the past two years.

Institute of Transport.

Among recent elections to membership of the Institute of Transport are Messrs. R. Letch, Regional Port Director, North Western Area (member) and G. A. Ashwell, Docks and Marine Accountant, Southampton (associate member).

Improvements at Harbour of Beira.

Retarded announcement is given of the deepening of all five berths at Pungwe Wharf, Port of Beira, East Africa, so as to afford a depth of 33-ft. alongside at any stage of the tide. The work was commenced some time ago and by this date is probably completed.

Coal Shipments on the Tyne.

Reports submitted to a recent meeting of the Tyne Improvement Commissioners showed that while coal shipments from the river over last year were generally lower than those for 1941, at a number of shipping places such shipments had shown an increase. Had production at Northumberland and Durham collieries been greater, it was stated, even better figures would have been obtained.

Abandonment of a Scottish Canal.

The Monkland Canal, an inland waterway in the Glasgow area, now disused, is shortly likely to be finally disposed of. The Corporation of Glasgow have been negotiating with the London, Midland and Scottish Railway for the acquisition of a section of the canal. The latter body have now indicated their willingness to abandon the canal, if the Ministry of War Transport agree, and to hand over to the city, an area of about 25 acres between Provan and Cumbernauld roads, the Corporation to bear the cost of filling in the basin. It is proposed that a formal agreement be entered into to regard the ground as common good property. This latest move is another step in the elimination of the canal system in Scotland, now largely in disuse because of alternative methods of transport.

Opposition to New Jersey Ship Canal.

The project for the construction of a ship canal across part of the State of New Jersey, U.S.A., from Raritan Bay to the Delaware River near the City of Bordentown, which has long been advocated by the Atlantic Deeper Waterways Association and is set out in a Bill now before the American War Department, is meeting with opposition from the United States War Department, which has reported adversely on the Bill in a letter to the chairman of the Senate Commerce Committee. Although recognising the high value of the proposed canal, which has been termed the "missing link," in the Atlantic coastal waterway system, the War Department considers it inopportune to embark on the project at this juncture because it would take several years to complete and its immediate commencement would be impracticable "on account of the need for devoting available material and men to work of more importance to the actual persecution of the war."

The Design of Sea Walls*

By C. E. FELLOWS, A.M.Inst., M. & Cy.E.

General Principle.

SEVERAL excellent papers have been written in recent years which have dealt with the various aspects of sea defence works, but so many diversities of opinion have been raised by these that an analysis of modern theory and practice in coastal work can be examined with advantage. This present article can only hope to deal with sea walls, and will not cover such items of marine work as groynes, jetties, piers, etc., since many more papers could be written on these alone.

It has been usual in previous decades to construct walls on a rather massive scale, generally of the gravity type, with vertical sections and monotonous features. Present practice is tending towards more rational designs in which many of the sections adopted are made to conform with the natural beach slopes and levels, or in which lighter construction is adopted whenever possible. It should not be inferred, from the preceding remarks that vertical walls should be regarded as useless and obsolete; far from it, since the vertical wall cannot always be superseded. It should be realised, however, that the vertical gravity wall for each and every type of defence is to be avoided and that it should only be adopted when the right occasion demands.

Some of the many factors which govern the type of wall to be erected will be discussed in the following paragraphs, but hard and fast rules cannot be laid down, since so much depends on local conditions. Before passing to these, however, it is to be noted that even the design of gravity walls has undergone radical changes in recent years.

The following are the main points which govern the construction of a sea wall and one or more should be satisfied before any works are proposed:—

(i) The wall is required to combat coast erosion.
(ii) It is to be built to further the development of some particular area or to extend or reclaim an area.
(iii) Its construction will be beneficial in training the sea or an estuary for some specially desirable purpose.

These are the primary requirements calling for the construction of a wall. Any other reasons are subsidiary to these and, in fact, can generally be classified into the above mentioned main heads.

The considerations affecting the type of wall to be erected are as follows:—

(i) The site and its geological features.
(ii) The local tides, currents and prevailing winds.
(iii) The littoral drift of the coastline under consideration.
(iv) The proposed use of the wall and land at the rear.
(v) The economy of construction.

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The site and its geological features play a most important part in the choice of wall section and it will be seen, for instance, that a wall to be built against a solid cliff face, to counteract erosion, will be vastly different from one required for a promenade scheme. The cliff wall would need to be of only a light section, for the solidity of the cliffs would relieve a considerable amount of the back pressure. Conversely the wall required for the promenade would in all probability be backed with loose filling and would therefore need to be of full section. The foundation available for the wall will also materially affect the design since on rocky shores the section will not need piling. On the other hand, a wall to be built on a sandy beach will no doubt require a piled foundation together with a close sheet piled vertical apron at the toe; this latter to prevent the possibility of scour action undermining the base.

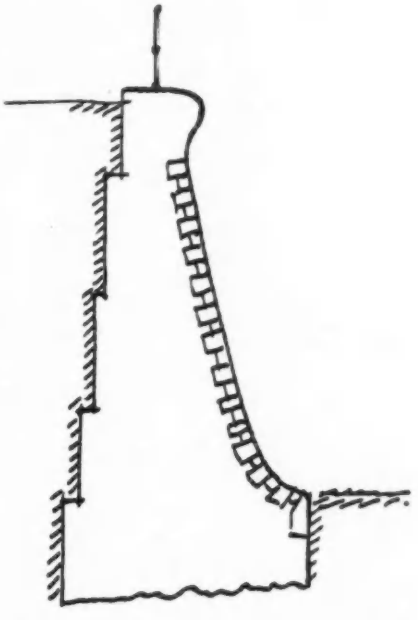


Fig. 1. Development in Design. Straight Face.

Tides and currents, in the particular area under consideration, will have a bearing on the design inasmuch as the wall may tend to alter these tidal directions and ranges. It has been observed on occasions that the building of a new wall has caused coastal areas in the immediate neighbourhood to either gain or lose tidal amenities, and in districts near to navigable rivers and estuaries every care must be taken to avoid interference with navigability. The erection of a wall may bring about silting in a river, which would be detrimental to the traffic using the waterway and which would also cause considerable expense in the subsequent necessary dredging of the channel.

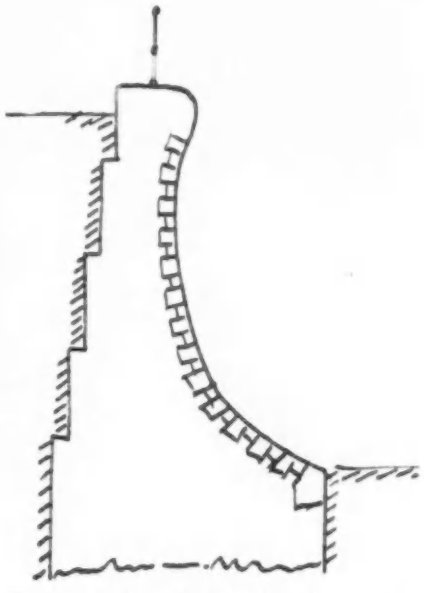


Fig. 2. Development in Design. Curved Face.

Closely allied to tides and currents are the effects of littoral drift. Broadly speaking this is the travel of beach and coastal material from place to place due to the tides. A general theory is that the travel of drift is in the direction of the set of flood tides;

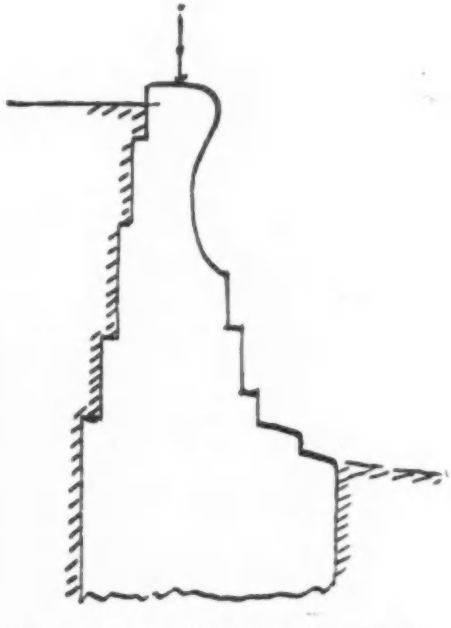


Fig. 3. Development in Design, Stepped Face.

The Design of Sea Walls—continued

drift being material carried in suspension in the water when in the flood, but deposited on the ebb. Observations around the coast will give the general travel of drift and every consideration should be given to it in the designs.

The ultimate use to which a wall will be put also affects the design. Walls which are required for the sole purpose of preventing erosion may be of the severest design and devoid of steps, seats, slipways, etc., but walls required for promenade works will need most of these features. It should be noted that the effect of any superloading, due to motor or pedestrian traffic, should be taken into account as should the superloads from shelters, bandstands, etc., if these are provided.

The conomy of construction will be related to all the above features. Due regard should be taken of the materials best suited for the work and their availability and ease of handling on the site. With these preliminary notes to hand it is now possible to examine more closely the various types of wall which can be erected.

Vertical Gravity Walls.

A plain " vertical " gravity wall, built on the principles of a mass retaining wall is not always a satisfactory form of defence. Such a wall is shown in fig. 1. Its main drawbacks are that it generally induces a considerable amount of scour with the accompanying dangers of loss of foundation material. The wall does not have much effect in reducing the spray which is thrown on to the back areas at high tides. It is, however,possible to counteract some of these shortcomings, as will be shown later, but it should be noted here that high vertical walls are generally required in exposed areas only, where a considerable tidal range is experienced on the wall ; or in positions where the land at the rear of the wall is very much higher than the high water mark of mean spring tides. In areas having only a small range of tide compared with the required wall height, more use can be made of reinforced concrete walls. To appreciate the necessary modification to a vertical wall it should be realised that an advancing wave, when suddenly arrested by a wall, divides into two forms, these being (a) surface mount and spray and (b) downward swirl and undertow. This latter causes scour at the base of the wall and erodes the foundations. In addition to this, the action of the sea, at that period of tide when the water is just moving about the toe of the wall, also produces contributory scour. Likewise the fall of upflung water, after being arrested by the toe, adds to the effect.

To counteract these actions the curved face wall has been produced, viz., fig. 2, but this does not completely remove the trouble. In recent years, however, an effective artifice has been developed which makes use of the curved face plus steppings. This form of wall is shown in fig. 3, and it will be seen that the steps have the effect of deflecting and breaking the induced back swirl. This stepping also has a similar effect in breaking the fall of water which has been upflung when arrested. It should also be noted that the sea, if thrown up above the top of a straight face wall will have a tendency to fall back on to the deck of the promenade, or in the case of a plain wall, the berm, particularly if an onshore wind is blowing. This spray and water is undesirable in such instances, since not only does it tend to " close " a promenade to pedestrian traffic during the high tide period but it also deposits considerable quantities of sand and pebbles on the back areas. This has a damaging effect on surfaces. Scuppers in the wall at deck level, together with a fall in the level of the deck towards the wall, tend to carry away some of this water. An attempt should be made to cure the trouble at its source and this may be done by providing a nosed coping to the wall. An angle of 20°-25° from the vertical is suitable and if an angle greater than this is desired the nose should be reinforced and "tied" to the main wall to avoid breaking and lifting in rough weather. This nosing may be conveniently designed to occur at a lower

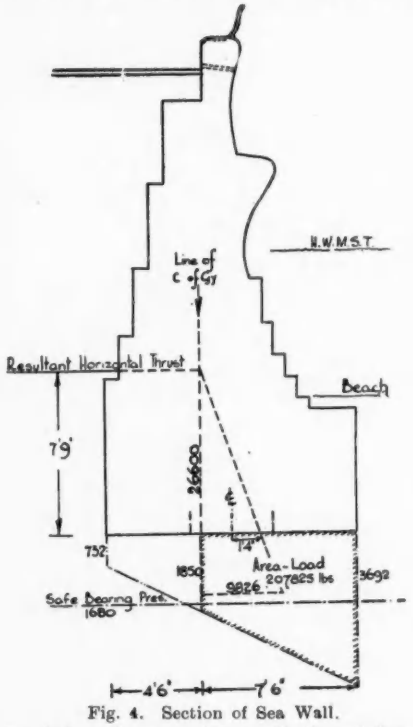


Fig. 4. Section of Sea Wall.

level than the top of the wall, thus deflecting the water and making further provision for keeping a dry hinter surface since any spray which might be blown back will not fall on the decking but strike against the second lift of the wall. The foregoing are some of the main points leading to the design and development of a wall face but one more point may be added here. This concerns facing material and it should be considered in conjunction with the modern practice of constructing walls in mass or reinforced concrete. If beach material is of a sandy nature then a plain concrete face may be conveniently given to the wall but if the material is likely to be pebbly and of an abrasive quality then some impermeable facing such as granite or basalt should be provided. Since this will probably be a costly refinement it may be replaced by flint faced cast-in-situ blocks. For borderline cases a slightly richer mix of concrete may be placed in the facing portion of the wall at the same time as the general concrete is poured.

The wall is designed in the same manner as an ordinary retaining wall, and with respect to this it is interesting to note that more often than not designs are based on the Rankine formula and not on any of the modified equations, which are sometimes used for inland retaining walls. Admittedly, for doubtful foundations, the higher values for earth pressure given by the Rankine formula err on the side of safety. No appreciation of the frictional resistance of the backing material and the wall is made in this formula but in the Rebhann method, for instance, this frictional resistance is admitted and slightly lower values for earth pressure are arrived at, with a consequent reduction in the wall section. The advisability of adopting methods which do give lower results is a debateable point but in cases where the back fill is say dry sand and the foundation is reasonabley solid, some other method, other than Rankine's, may be adopted.

In cases where the foundation is very doubtful no useful purpose can be achieved in adopting a method likely to give low results and the Rankine formula may then be used. Piling will probably have to be adopted if the foundation to the wall is unstable and an example of a piled mass wall is given below. See also figs. 4 and 5.

General Data.

Wall to be built on beach foundation of $\frac{3}{4}$ tons per sq. ft. bearing capacity. Depth to good foundation is 15′ 0″. Filling to be dry sand at 110 lbs. per cubic ft., with an angle of repose of 30°. Centre of gravity of section is at 4′ 6″ from back of wall.

Calculation of Earth Pressure.

In a case such as this, where the general conditions cannot be appreciated with any degree of accuracy the Rankine formula will give a safe figure for the earth pressures likely to be set up.

$$\therefore \text{Pressure} = P = \frac{wh^2}{2}\left(\frac{1-\sin\theta}{1+\sin\theta}\right)$$

$$= \frac{110 \times 22^2}{2} \times .33 = 8873 \text{ lbs.}$$

$$\therefore \text{Moment} = 8873 \times \frac{22}{3} = 65070 \text{ lbs. ft.}$$

and Superload from promenade traffic, at 130 lbs. per s. ft. gives a pressure

$$S = wh\left(\frac{1-\sin\theta}{1+\sin\theta}\right)$$

$$= 130 \times 22 \times .33 = 953 \text{ lbs.}$$

$$\therefore \text{Moment} = 953 \times \frac{22}{2} = 10483 \text{ lbs. ft.}$$

The Design of Sea Walls—continued

Now Sum of Pressures = 8873 + 953 = 9826

and Sum of Moments = 65070 + 10483 = 75553

and Resultant of pressures $= \frac{75553}{9826} = 7.7$

say 7′ 9″.

Wt. of wall and part earth backing, per foot run

$= 190 \times 1 \times 140$ lbs. per cubic ft.

$= 26600.0$ lbs.

Combining thrust and weight, graphically, as shown, the line of the resultant falls within the middle third.

Foundation Pressure.

From the equation $P = \frac{W}{Ba} \pm \frac{M}{Z}$

Where W = Weight,
Ba = Base area
M = Bending Moment of eccentriciy
Z = Modulus of Section

$= \frac{BD^2}{6} = 24$

Then $P = \frac{26600}{12 \times 1} \pm \frac{26600 \times 1.33}{24}$

$= 2212 \pm 1480$

$= 3692$ lbs. $= 1.65$ tons

$= 732$ lbs. $= .32$ tons.

But the allowable stress for the foundations is .75 tons, so that the wall will require piling. The necessity for piling is also supported by an examination of the resistance of the wall to sliding; as follows;

$26600 \times .25 = 6660$ lbs.

which is less than the thrust of 9826 lbs.

Piling.

The total load which can be carried on one pile if the piles are driven at 10′ 0″ longitudinal spacing is as follows:

Area (Centre of Gravity to Toe) $\frac{1850 + 3692}{2} = 2771$

and $2771 \times 7.5 = 20782.5$ lbs.

$\therefore \frac{20782.5 \times 10.0}{2240} = 93$ tons.

Deduct bearing value of ground at $\frac{3}{4}$ ton per sq. foot. Then actual load on pile

$= 93 - .75 \times 10 \times 7.5$

$= 93 - 56 = 37$ tons.

Try a 12″ x 12″ pile.

The safe load on such a pile, when considered as a column is calculated from,

$W = [A + (m-1)A_s]\ c_s$

Where A = Area of pile
$= 12'' \times 12'' = 144$ sq. in.
m = Modular ratio = 15
A_s = Area of longitudinal reinforcement = 1% of total area
$= 1.44$ in.²

c_s = Safe Stress $= \frac{c}{1 + 0.0012R^2}$

(where $R = \frac{H}{D} = \frac{15'}{12''} = 15$ the free height, width ratio).

$= \frac{750}{1 + 0.0012 \times 15^2} = 590$

Thus $W = [144 + (15\text{-}1)\ 1.44] \times 590$

$= [144 + 16.4]\ 590$

$= \frac{94300}{2240} = 42$ tons.

Carrying capacity as a pile, allowing a 25 cwts. hammer 3′ 0″ drop and 1″ set over the last 10 blows.

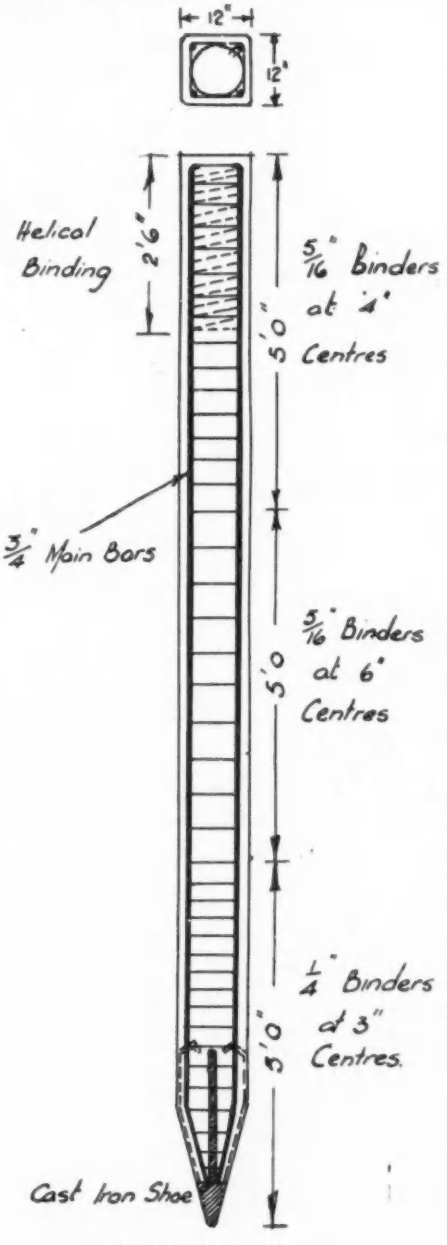


Fig. 5. Concrete Pile.

Then weight of pile $= \frac{145 \times 15 \times 1^2}{2240} = .97$ tons, say 1 ton

By Weisbach's formula $P = \frac{W^2 h}{5S(W+x)}$

Where W = weight of ram, tons
S = depth of last drive
h = height of fall
x — weight of pile tons

$\therefore P = \frac{(1.25)^2 \times 36}{5 \times \frac{1}{10} \times (1.25 + 1)} = 50$ tons.

Piles.

Longitudinal reinforcement of 4 No. $\frac{3}{4}$″ dia. bars (1.77 sq. ins.) will suffice whilst $\frac{1}{4}$″ binders at 3″ centres for 5′ 0″ from the shoe, $\frac{5}{16}$″ binders at 6″ centres for the middle 5′ 0″ of the pile, and $\frac{5}{16}$″ binders at 4″ centres for the upper third of the pile, should be placed. The pile is as shown in fig. 5.

The practical construction of such a wall would form the basis of at least one article, alone, so that only a brief outline can be given here. The wall, if of considerable length would probably be most economically built with specially designed steel repetition shuttering, with additional timber formwork for step and slips. A four lift design of formwork would adequately suit the purpose, with lifts as follows, 1st lift, Foundation and haunches; 2nd lift, Wall proper; 3rd lift, coping; 4th lift, Upper coping. The vertical apron piling which is desirable at the front of the wall and also the back piling should be driven first, so that foundation excavation can take place. This piling needs very exceptional care during driving as the sea can tear this out and distribute it in the most amazing ways, at times of winter gales. Adequate strutting and bracing between the temporary working dams must be provided.

The construction of the wall must be controlled carefully with regard to materials, mixes, etc., and specialists inspectors are an economical proposition on works of any size in addition to the resident engineer and clerk of works.

No mention has so far been made of the vexed question of expansion joints but generally these should be provided at intervals of 50′ 0″ and should extend over the full sectional area of the wall with a thickness of $\frac{3}{8}$″ to $\frac{1}{2}$″.

It is also advisable to provide an adequate system of subsoil and backwall drainage which may be gathered and discharged at convenient points.

Reinforced Concrete Walls.

The use of light section reinforced concrete walls has not yet been fully developed but it will be found practicable in many instances to adopt such a construction in favour of mass walls. These light section walls may be used to advantage in districts not subject to heavy gales and where the beach is not built of abrasive materials. It will be realised that where the angle of the

The Design of Sea Walls—continued

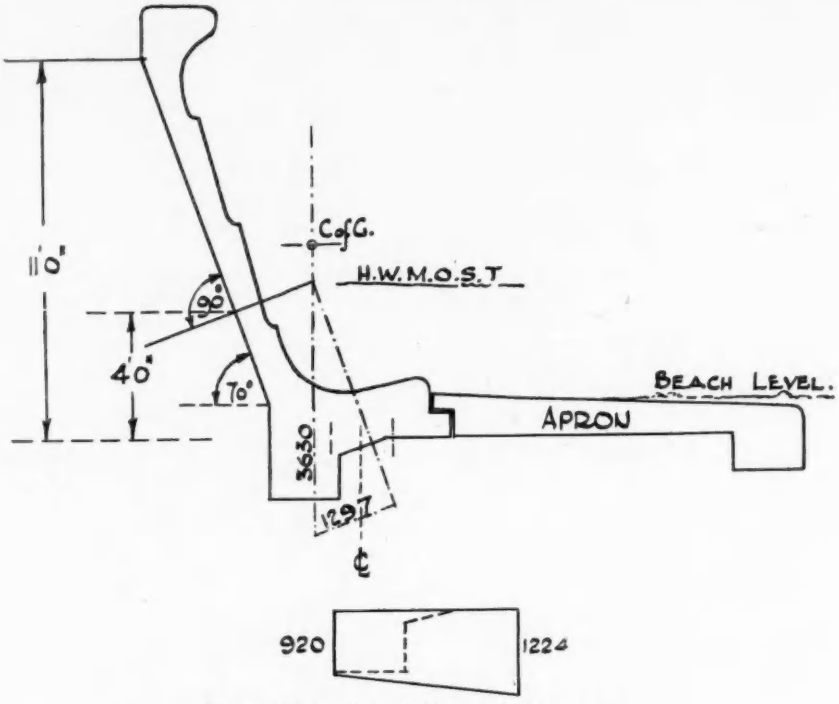


Fig. 6. Illustrating calculations for sloping wall.

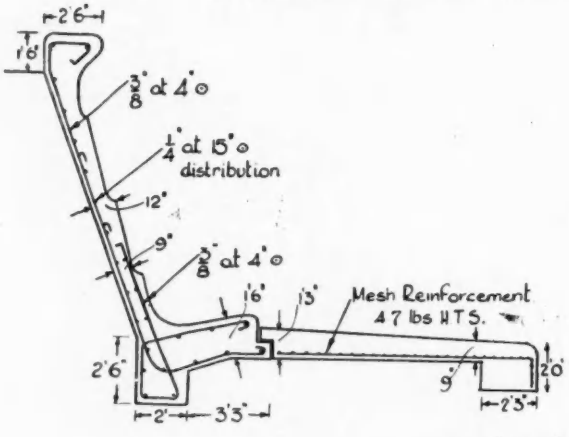


Fig. 7.
Layout for reinforcement.
Section.

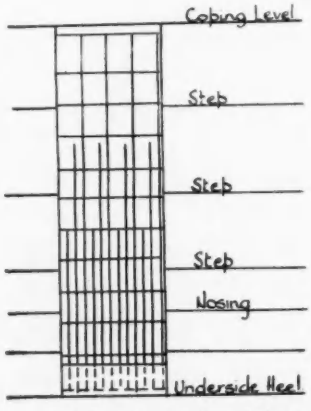


Fig. 7a. Layout for reinforcement.
Elevation.

rear face of the wall is the same as that of the angle of repose for the material, no reinforcement is theoretically required, but as a practical measure a nominal amount should be provided to act as distribution and to provide a "tie" for the whole structure. The reinforcement will also take care of any superload stresses which may be set up. A typical wall is shown in fig. 9. Where the slope of the wall is steeper than the angle of repose of the retained material it will be found necessary to calculate for the wall. Such a calculation is shown below and is illustrated by fig. 6. The finished wall showing a suitable layout for the reinforcement, etc., is shown in fig. 7, and it will be noticed in this that the apron has been reinforced with a proprietory mesh rather than a built up system of bars. This mesh will provide the necessary resistance required and will be as economical as a built system.

General Data.

The wall is to be built on a gravel and sand beach of approximately ¾ ton per square foot bearing capacity. Backfilling is to be sand of 110 lbs. per cubic ft. weight having an angle of repose of 30° and a coefficient of resistance of 0.3.

Calculation of Earth Pressure.

$$P=\frac{Kwh^2}{2}$$

$$\text{where } K=\left[\frac{\sin(\beta-\theta)}{(n+1)\sin\beta}\right]^2\times\frac{1}{\sin\beta}$$

and for sand $\theta=30°$ whilst β for the wall $=70°$

and where

$$n=\sqrt{\frac{\sin\theta}{\sin\beta}}=\sqrt{\frac{.5}{.9397}}=\sqrt{.5330}=.73$$

$$\therefore K=\left[\frac{\sin(40°)}{1.73\sin 70}\right]^2\times\frac{1}{\sin 70}$$

$$=\left[\frac{.6428}{1.73\times.9397}\right]^2\times\frac{1}{.9397}$$

$$=.39^2\times1.065=.162$$

$$\text{Thus } P=\frac{.162\times110\times11.0^2}{2}$$

$$=1080 \text{ lbs. acting at } \frac{h}{3}$$

$$\therefore \text{Moment}=1080\times\frac{11}{3}=3960$$

In addition to this pressure there is a pressure due to the superload of 120 lbs. per square foot, as follows :—

$$P_s=SKH$$

$$=120\times.162\times11$$

$$=217.4 \text{ lbs. acting at } \frac{h}{2}$$

$$\therefore \text{Moment}=217\times5.5=1192$$

$$\text{Now Sum of Pressures} = \begin{array}{r}1080\\217\\\hline1297\end{array}$$

$$\text{and Sum of Moments} = \begin{array}{r}3960\\1192\\\hline5152\end{array}$$

$$\text{Resultant of Pressures}=\frac{5152}{1297}=4'\ 0''.$$

Now the weight of the wall is

$$25.21\times1\times144$$

$$=3630.24 \text{ lbs.}$$

Combining thrust and weight as shown, it will be seen that the resultant falls within the middle third of the base.

The Design of Sea Walls—continued

Ground Pressure.

$$P = \frac{W}{Ba} \pm \frac{M}{Z}$$

$$P = \frac{3630.24}{5.25 \times 1} \pm \frac{3630.24 \times 1}{24}$$

$$= 1072 \pm 152$$

$$= 1224 \text{ and } 920$$

or say $= .55$ tons and $.41$ tons.

The foundation is therefore satisfactory.

Sliding.

The coefficient of resistance to sliding is 0.3.
So that $3630.24 \times .3 = 1089.072$.
This is less than the thrust of 1297 lbs. so that a rib and base, of the design shown, is necessary to provide resistance to sliding.

Bending Moment.

From Backing $1080 \times 3' 8''$
$= 1080 \times 3.67$
$=$ say 4000 lbs. ft.
$=$ 48000 lbs. ins.
From superload $217 \times 5' 6''$
$=$ say 1192 lbs. ft.
$=$ 14304 lbs. ins.
Total $=$ 62304 lbs. ins.
And Resistance Moment
$= 95 \times 12 \times d^2$

$$\therefore d^2 = \frac{62304}{95 \times 12} = 54.5$$

$d =$ say $7\frac{1}{2}''$
Add $1\frac{1}{2}''$ for cover
$= 9''$ for general thickness.
Add 3" for steppings
$= 12''$ for stepped thickness.

In view of the design features of the wall it is advisable, in the interest of economy, to continue the wall throughout its height at the same thicknesses of 9" and 12".

Where a_1 = lever arm ratio
d = depth
t = steel stress

$$\text{Steel Area} = \frac{M}{a_1 dt}$$

$$= \frac{62304}{.86 \times 12 \times 16000}$$

$= .375$ sq. ins.

say $\frac{3}{8}''$ bars at 4" centres.

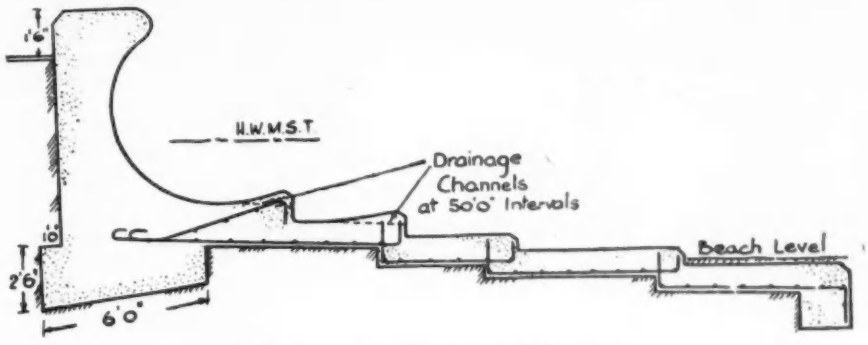


Fig. 8. A type of specially designed sea wall.

Shear.

This acts over a height of 10' 0" of the wall and is maximum at the junction of the base and wall. Its value is thus equal to the horizontal thrust occurring in a wall 10' 0" high.

$$\text{Hence Shear} = \frac{Kwh^2}{2}$$

$$K = \left[\frac{\sin(\beta - \theta)}{(n+1)\sin\beta}\right]^2 \times \frac{1}{\sin\beta} \text{ and}$$

$$n = \sqrt{\frac{\sin\theta}{\sin\beta}}$$

$$\therefore S = \frac{0.162 \times 100 \times 10^2}{2} = 810 \text{ lbs.}$$

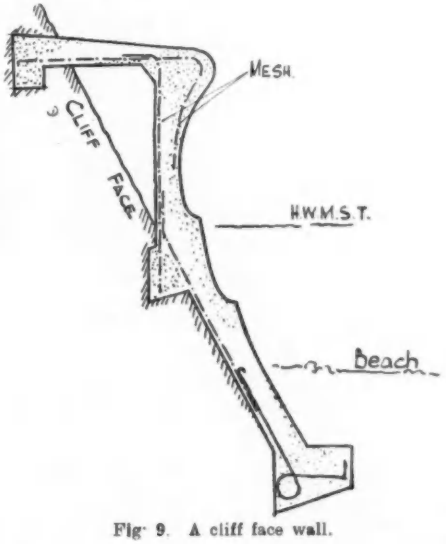


Fig. 9. A cliff face wall.

This gives an average shear stress on the full thickness of the wall equal to

$$\frac{810}{12 \times 10} = 6.7 \text{ lbs. per sq. inch.}$$

Thus no shear reinforcement is required but $\frac{1}{4}''$ bars at 15" centres should be provided as distribution steel.

A further type of wall which is sometimes constructed with advantage is as shown in fig. 8. This type conforms more to the natural slopes of the foreshore and is suitable where the tidal range is not extensive and the land at the back of the wall is not very much higher than H.W.M.S.T. level. It will be noticed that the top two step platforms are upswept at their nosings in opposition to the other steps which slope downwards. The reason for this detail of design is that a wall having every step sloping downwards often gives rise to considerable scour and backswirl but the uplift of nosings tends to prevent this. Drainage scuppers in these nosings, combined with suitable longitudinal falls in the steppings, prevents any sea water from lying in the channelled steps during low tide.

There would appear to be one disadvantage to this type of wall and that is slipperiness due to marine growths.

All the various types and sections of wall in use, cannot be described and illustrated in the scope of this present article, but it is hoped that some points for discussion and further development have been raised herein, since only by constructive criticism and discussion can improvements be effected.

Scottish Harbour Debts.

Loans to Scottish harbours were the subject of enquiry by the Committee of Public Accounts, whose report was issued recently. In the report occurs a curious slip by Col. Elliot, chairman of the enquiry, confusing Banffshire and Aberdeenshire.

He pointed out to a Treasury witness that Anstruther Union and Buckie Council had had fairly large advances and that in the case of Macduff the principal and interest were eighteen years in arrears. He asked if that was simply due to the depression in these small fishing ports, and Sir Richard Hopkins, Permanent Secretary to the Treasury, said that, generally speaking, he thought that it was, adding, however, that Buckie Town Council was now beginning to show a better record.

The chairman remarked that these were mostly East Coast ports, and in Aberdeenshire at that, and he asked Sir Richard if he anticipated being able to do anything about those accounts in future. In reply, Sir Richard said they would have to leave them until after the war. It was quite impossible to see what their position would then be.

Buckie and Macduff are, of course, in Banffshire, and Anstruther in Fife.

The Salvage of the Dredger "Alcantara"*

A Portuguese Harbour Problem and its Solution

By Engineer SALVADOR DE SA NOGUEIRA,
Inspector of Salvage in the Tagus, Secretary to the Board of Naval Administration.

(Concluded from page 233)

SOLUTION OF THE PROBLEM.

The scientific and elegant solution, had there been in our port a dry dock capable of receiving and floating it and a depth of water alongside quay of, at least, 12 metres, would have been to keep the dredger afloat in its inverted position and to deposit it in the dock and maintain it there in the dry state; then, after dismantling it of all detachable parts, including its buckets, it would have been possible to close it hermetically and transfer it afresh

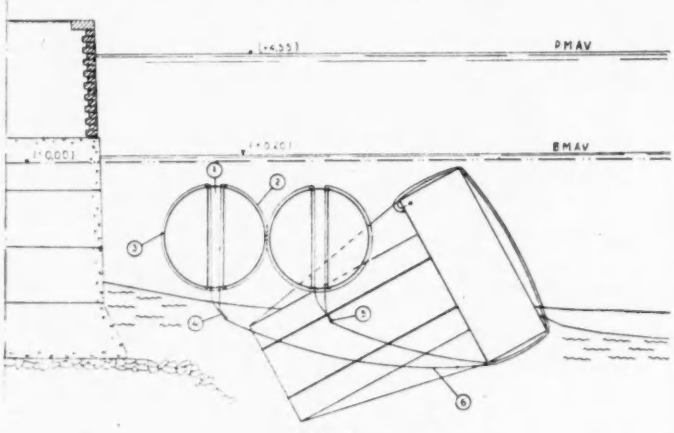


Fig. 9.

Righting of dredger "Alcantara." Diagram of transverse section: 1. Hawser-holes. 2. Extremity of the steel cable. 3. Driving cylinder. 4. Foot of the web-tackle for attachment to the tow-cables. 5. Attachment shackle. 6. Tow-cable.

outside the dock to a locality where it would be feasible to veer it over into an upright position by the application of co-ordinated forces, the resultant of which would prove adequate for the aim in view.

To keep the dredger afloat under the conditions indicated would have proved no easy undertaking, as it would have involved the preparation of conduits or other suitable means for the ingress of air into the water-tight compartments. Moreover, the resistance set up by the parts embedded in the mud compelled us to have resort to a different solution.

To right the vessel *in situ* with the aid of the buoyancy it possessed was a suggestion that was also considered.

In the meantime, however, the dredger, becoming gradually deprived of its remaining buoyancy, showed a tendency to heel over and ended by doing so completely as already stated. (Figs. 4, 5 and 6).

In carrying out the removal from the site where it foundered, it was necessary, at all costs, to take into account the berthage requirements of the adjacent quay. The arrangements had, besides, to be so planned as to allow of the arrival being completed in as short an interval as possible so as to satisfy the great demand for dredgers always obtaining in the harbour of Lisbon, and so as to maintain mooring sites at suitable spots along the quays as well as in the various navigable channels and basins.

Three basic operations had to be carried out before the dredger could be refloated: It had to be righted, suspended and drained.

Righting suspension and drainage are, therefore, the titles and the subject matter of the three sub-sections that follow.

The dredger *Alcântara* was built in Holland in 1929.

It is, of course, a bucket dredger, with an hourly dredging capacity of 500 cubic metres, its leading characteristics being: Length, 42 metres; mouth, 8 metres; hold depth 3.10 metres.

It is not self-propelling, but is provided with a steam installation intended for the actuation of the buckets, cranes, ladder, etc., and consisting of a two-furnace cylindrical boiler adapted for a pressure of 150 lbs. and a "compound" engine of 300 h.p. (See illustration of dredger).

Righting

Fig. 9 will serve to convey a sufficiently clear idea of the position of the dredger after foundering, through losing the residuum of buoyancy that kept it afloat upside down.

The contacting edge B B exhibits a double inclination relatively to the pier-wall, specified by distances of 14 m. and 19.5 m. respectively, from the facing of the latter to the extremities of the poop and the prow, and relatively to a horizontal passing through the centre of the said line and defined by its distance from the same points, viz. + 1 m. and − 1 m. respectively. Advantage was taken of the low-water to verify the abutment of the centre of the ship along its stern. When the high tide set in, the dredger was observed to be completely submerged with a body of water of some 4 m. in depth above its central section. (Figs. 2 and 3).

The narrowness of the space between the dock wall and the foundered vessel constituted, obviously, an impediment of serious import for the operations.

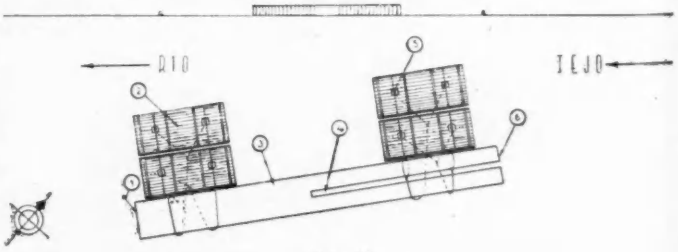


Fig. 10.

Righting of the dredger "Alcantara." Diagram plan: 1. Prow. 2. Air valves. 3. Bottom of dredger. 4. Ladder space. 5. Hawser-holes of driving cylinders. 6. Poop.

The congestion, within this area, of equipment huddled together after the capsizing of the dredger, and more specifically the turret, ladder, chain of buckets, lockers, zinc coverings, wire lengths, cables, etc., embedded all of them in the mud, gave rise to difficulties in the operations greater even than those due to the narrowness.

These difficulties were formidable enough to render it impossible to pass guide cables under the stranded vessel, as was successfully done in the case of the tug *Cabo Sardão*.

An attempt was made to overcome these impediments with the aid of compressed air, conducted through a galvanised iron tube

*Translated from the Portuguese official account in a Report submitted to a Meeting of Engineers on May 29th, 1940. The preparation of the drawings and photographs for this article was supervised by Engineer Leo Muginstein.

Salvage of the Dredger "Alcantara"—continued

of adequate length and flexibility. The air was intended to open up a path for the tube. Every attempt, however, was frustrated, the obstacle being so insuperable that the tube could not make headway beyond certain limits; it was finally imperative to desist and to adopt some other procedure more in keeping with the difficulties of the environment.

Among the many suggestions proposed for the purpose of righting the dredger, the one that commended itself to me as the most promising was that of passing tow cables around the vessel, one of the leash-hawsers of which was secured to points on the deck beside B B, while the other was secured to the driving cylinders. Additional power could be drawn from the other cylinder functioning as weight and not intended to drive.

The employment of windlasses was also resorted to for the purpose of aiding the operation of righting.

Thanks solely to the possibility of being able to pass guide ropes under the bottom of the dredger at the extremities of both poop and prow, the solution of the problem was narrowed down to this condition.

As soon as it was observed that a couple of the motive cylinders were located, with their generating lines in contact, in the space between the dredger and the dock wall, I resolved to dispose one so as to render each extremity accessible as indicated in Figs. 9 and 10, in the expectation that this would reveal how and where

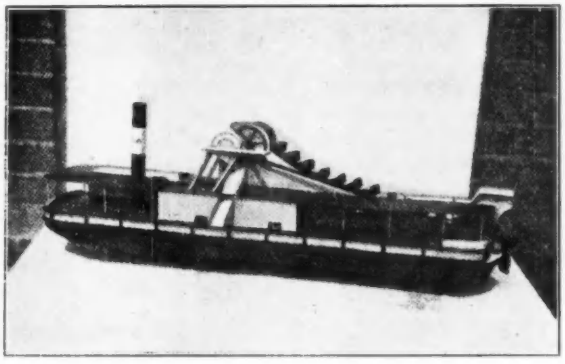


Fig. 11.
Model of the bucket-dredger "Alcantara"
(Port of Lisbon Authority).

the joints were made. The directional moment of the driving forces relatively to the contact line E, B, which functioned here as an axis of rotation, was sufficient to overcome the oppositely directed moment of the dredger weight. Leaving out of account the moment of the resultant forces obtained by the employment of cylinders, as also the resistance of the medium and other unforeseen, because unforeseeable, resistances, the operation was finally greatly facilitated by the employment of a floating crane of 100 tons lifting capacity, the *Antonio Augusto de Aguiar*.

The solution thus devised was tested with the aid of models of the dredger and of the cylinders referred to, and this test is here reproduced at this Conference for the benefit of those listening to me, although the photographs here exhibited will hardly suffice to convey any adequate idea to the reader. (Figs. 11, 12 and 13).

With a view to preventing the dredger, once it was turned over, from settling down with an enormous bottom surface in the mud and thus avoiding a highly detrimental force of adhesion, I gave instructions for the cutting out of a box cavity of suitable dimensions which was to be filled with sand. The amount of mud dredged was roughly 5,000 cubic metres and the volume of sand shot into the box was about 1,500 cubic metres. (Figs. 3, 4, 5 and 6).

In order to protect the tow-cables of steel from the cutting effects of the operating edges of the dredger, there were interposed as far as possible between the extremities and the cutting edges, sheaths of iron plate expressly prepared for the purpose.

Thus, after a long period of unceasing effort, rendered more arduous by the local conditions and by unfavourable weather, with the driving cylinders buoyed up with the aid of compressed air and started into operation with the help of the 100-ton crane already referred to, the power from which was brought to bear on the turret by means of the hawser thrown round it, on the 4th

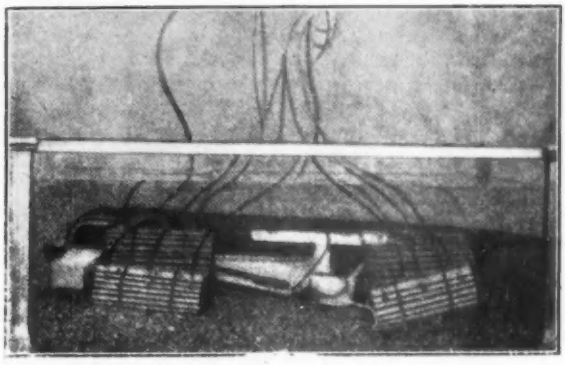


Fig. 12.
View of the experimental tank and the model of the dredger, with models of the cylinders attached and ready for righting. As seen from the side of the turret.

of March, that is approximately two months after the dredger subsided, it was, at long last, righted in a position contiguous to E, B, and inclined thereto at an angle of about 20° (Figs. 14, 15 and 16).

As it appeared unnecessary to lessen this inclination, transition was at once made to the second major operation:

Suspension and Lifting

The suspension was effected with the aid of three pairs of driving cylinders arranged symmetrically on the two ship-decks.

The preliminary operations involved comprised the following:—

1. Removing the cylinders and severing the connecting unions. (Fig. 17).

2. Removal of the ladder and the bucket chain. To accomplish this, it was necessary to make a careful use of a submarine cutting apparatus.

The opacity in the water presented a very serious obstacle to the employment of the apparatus. In virtue, however, of the unflagging determination and skill of the divers and of the energy and zeal of all concerned, and an unlimited and suitable equipment, every difficulty was overcome and, on March 28th, the ladder was extricated with the aid of the *António Augusto de*

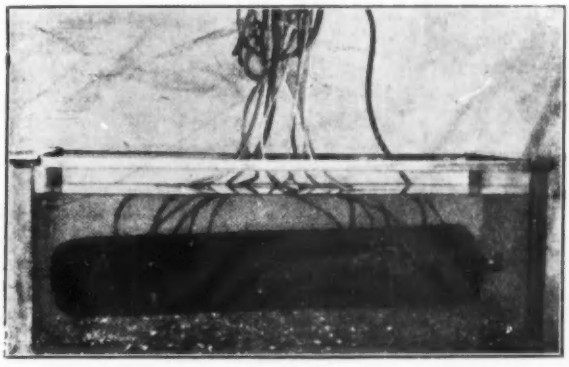


Fig. 13.
View of the experimental tank with the model of the dredger, together with models of the cylinders attached and ready for righting. As viewed from the under side.

Aguiar; on the 29th the buckets attached under the former, besides other accessible elements that had already been dismantled, were likewise retrieved.

Some other more or less accessible fitments were then removed.

Salvage of the Dredger "Alcantara"—continued

The decrease in weight arising from so many removals contributed very largely to the comparative ease with which the dredger was hoisted.

3. Clearing the hull at the E, B side of the articles and material that had dropped into it as a result of the capsizing.

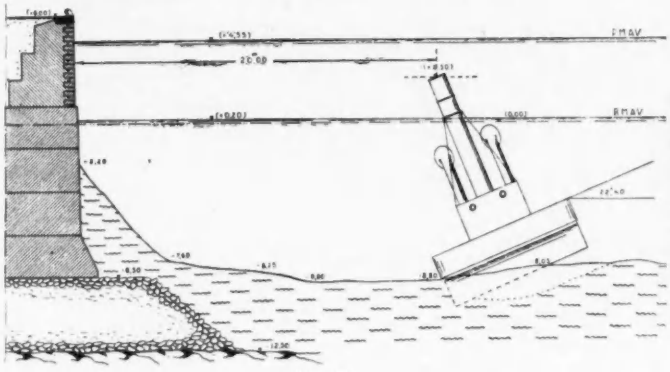


Fig. 14.

Cross-section taken through the prow of the dredger "Alcantara" after it had been righted on March 4th, 1940.

The operation was carried out by the hopper dredger *Engenheiro Matos*.

After being thus rid of parasitic encumbrances, it was towed to a spot suitable for the mounting of the cylinders on board.

4. The slinging of six guide-cables under and around the dredger: these cables had a diameter of $\frac{3}{4}$-in.

These cables were, moreover, equipped with extremities of steel enabling them to cut by friction into the solid angles of the vessel's frame. In this operation remarkably good results were obtained from a triangular metal plate (see Fig. 4) which allowed of two cables being strung round simultaneously without interfering one with the other. This method was suggested by the diver, Jaime de Almeida, and recommended by him as an expedient for facilitating the work.

5. The encircling of the dredger below with stout belaying ropes by way of reinforcing the guide cables; these belaying ropes were of 60.3 mm. in diameter and were intended to carry the weight of the dredger during its hoisting. The employment of flexible cables for this purpose had to be ruled out as they could not withstand the cutting effects of the frame skeleton which forms the shroud of this class of vessel.

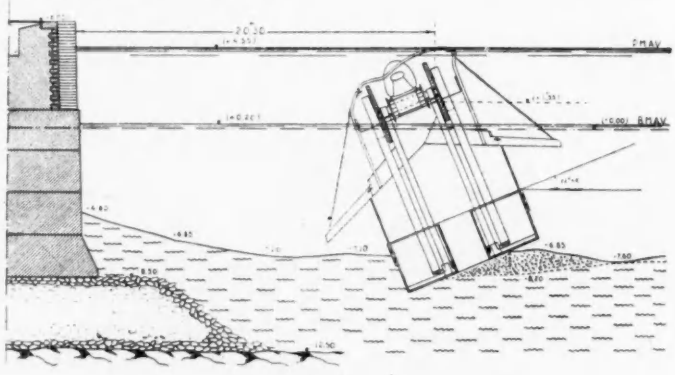


Fig. 15.

Transverse section taken in the vicinity of the central part of the dredger "Alcantara" after it had been righted on March 4th, 1940.

The slinging of the guide-cables and the fixing of belaying ropes under the ship was effected with the aid of the cranes *Adolfo Loureiro*, of 45 tons, and *António Augusto de Aguiar*, of the tugs *Cabo Espichel*, of 1,500 h.p., *Cabo de Roca*, of 450 h.p., *Cabo de Sines*, of 350 h.p., and *Figueira da Foz*, of 250 h.p., supplemented by the hopper dredger *Engenheiro Matos*.

6. To secure the driving cylinders, already positioned, to the six belaying ropes by means of substantial clamps as illustrated in Figs. 4 and 5.

The part of the work was done by the divers with the aid of a winch.

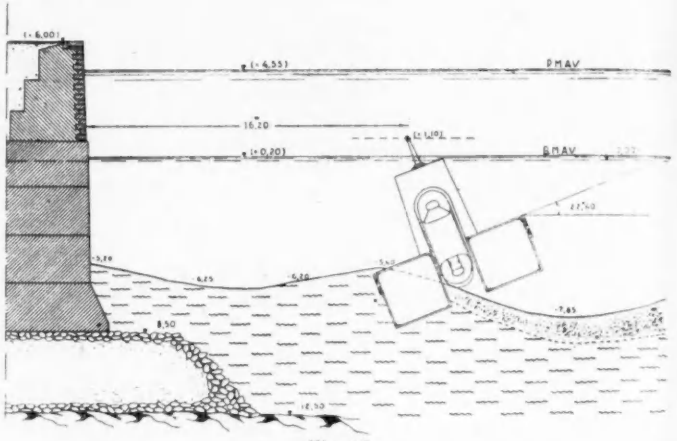


Fig. 16.

Cross-section through the poop of the dredger "Alcantara" subsequent to its righting on March 4th, 1940.

Of each couple of cylinders, the cylinder of E B was always secured before that of B B.

7. The connecting of the cylinders with the leather hose pipes for the conduction of air compressed by compressors expressly arranged for the draining-off of the said cylinders.

When matters had advanced thus far and the cylinders had been exhausted, the dredger, on the 8th of the same month detached itself from the mud bottom and was towed to the *Margueira* where it was moored during the full tide of the evening. (Fig. 18).

With a view to preventing an inflow of water that would otherwise have been set up by the cylinders, the parallelopiped fitments between which was formed a free passage, two substantial frames of wood were inserted.

The entire system was towed by the tug boats *Cabo Espichel* and *Cabo da Roca* at the prow and with *Cabo de Sines* and *Figueira da Foz* as side escorts.

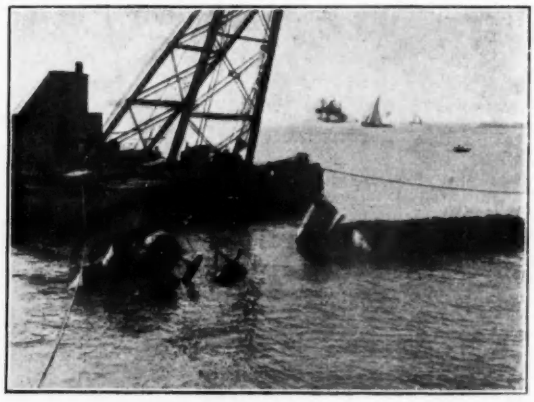


Fig. 17.

View of the complete outfit on March 4th, 1940, after the righting of the bucket dredger "Alcantara."

The last but one of these tug boats, equipped with a small compressor, had also a second compressor on board, both in readiness for all contingencies.

Drainage

At low water on the morning of the 9th day of April, 1940, everything on deck, was, as far as possible, removed; mud, metal

Salvage of the Dredger "Alcantara"—continued

platings, lockers, a crane, etc., as a result of which the vessel had its weight considerably lightened.

On the next day, also at low water, the liners of the cylinders were shrunk by interposing slips of wood between them and the cylinders.

In these operations of clearing and shrinking, use was made of the floating crane *Adolfo Loureiro* and the excavator *Engenheiro Matos*.

With the liners curtailed and the central compartments of the cylinders drained afresh, the dredger swung up into suspension and the entire convoy was guided to a mooring spot where the depth was 11 metres, and there the dredger was once more submerged by the inundation of its central compartments.

The re-drainage thus entailed was carried out on the 11th and the entire system was then towed to the dry dock No. 1 of the Port of Lisbon Authority, which it duly entered at 4.30 p.m.

After the dock had been emptied, the final drainage of the dredger was taken in hand and the compartments were cleansed of the mud adhering to them. The dock was again floated on the 13th and at 6.30 p.m. of the same day the dredger headed for the ocean.

Thus there had elapsed 4 months and 13 days since the date of its capsizing, and for the greater part of this period it had been submerged.

It thus regained the powers of buoyancy it formerly possessed and still possesses now, thanks to the unflinching determination and the persevering energy manifested, to the patience and serene confidence in success that were evinced in overcoming setbacks of every description.

To the intelligence, capability, skill and devotion of all my collaborators as well as to the excellence of the equipment employed, is largely due the success of the undertaking and the practical application on a really great scale of an idea conceived in the solitude of the consulting chamber and experimentally realised with a roughly-contrived model in an improvised test laboratory. And it is a pleasing duty for me to signal out for commendation the names of my valued collaborators to whom a public testimonial would be an acknowledgment more in keeping with their services; but reverting to the formality adopted at the meeting that was held in January of this year in connection with the salvaging of the tug *Cabo Sardão*, I shall take the liberty of reading also the "Service Order," published in the Port of Lisbon and containing the instructions relating to the operations in the salvaging of the dredger:—

> "On the 31st day of December, of 1939, somewhere around midnight, a violent hurricane was suddenly unleashed in the Tagus which capsized the dredger *Alcântara*, engaged at that time in dredging at the new quay of Santa Apolónia. A few days later it went down, turning topsy-turvy, with the entire rigging, part of the deck and part of the starboard side, funnel, turret and spiral coil embedded in the mud.
>
> "Two essential operations had, consequently, to be carried out; the first consisted in causing the dredger to heel over through roughly 180 degrees so as to position it with the bottom downwards, and the second operation was that of hoisting and suspending it so that it could be transported to the dry dock.
>
> "Difficulties all but unprecedented were met with, arising from the fortuitous position of the dredger and the silt into which it had subsided, rendered more acute by the total lack of visibility inside the water, the extreme hazard in keeping the pipes to the divers' belts intact, the phenomenal overflow and recession of tides and, finally, the wretched weather that prevailed from the day of the disaster until the date of arrival at the dry dock; but in spite of all such discouragements, no effort was spared in the attainment of the goal in view.
>
> "Time and again, the efficiency, intelligence and devotion of all my comrades co-operating in the work were severely tested, and time and again the proof given by one and all, each in his own sphere, was brilliant. It is with infinite satisfaction that I record this.
>
> "The instructions given in Service Order No. 2,158 of December 5th, 1939, relating to the salvage of the tug boat *Cabo Sardão* were repeated in this instance.
>
> "For special and signal services rendered, though without minimising the aid given by anyone, mention may be made of the Commanders Luiz Vaz Spencer and Manuel Bento, the divers Jaime and Januario de Almeida and of Manuel de Oliveira, Junr., maritime average surveyor, who was entrusted with the supervision of the operations; this latter name being intended to symbolise the esteem I feel for all his colleagues as well as himself, whose names appear in special lists published as supplementary to this present Order. The engineers Estêvão José Catalão and Leo Muginstein also deserve honourable mention.
>
> "Lastly, owing to the fine co-ordination of everyone's efforts and their effective co-operation concentrated on the accomplishment of the undertaking, I was able to bring it to a successful issue, the credit for which I gratefully acknowledge in this formal testimonial which falls short of doing justice to their merits."

Fig. 18.
View of the complete convoy consisting of "dredger and cylinders" in suspension on April 8th, 1940.

I shall not attempt a complete list of the personnel whose assiduity was so conspicuous; this would lead me too far, and interested parties are referred to, for instance, the O.S. where further details will be found.

Materials Employed

In the foregoing operations of righting and suspending the dredger, the following—among other—quantities of materials were utilised, the majority of which I had already approved on the *Cabo Sardão*.

Iron wire of 60 mm. in diameter	82 m
Iron wire of 50 mm. in diameter	10 m
Iron wire of 38 mm. in diameter	54 m
Iron wire of 19 mm in diameter	420 m
Steel wire of 55 mm. in diameter	10 m
Steel wire of 50 mm. in diameter	120 m
Steel wire of 40 mm. in diameter	1050 m
Steel wire of 35 mm. in diameter	160 m

Salvage of the Dredger "Alcantara"—continued

Steel wire of 25 mm. in diameter	1000 m
Steel wire of 15 mm. in diameter	300 m
Iron shackles (clamps), various standards ...	100
Clamping cable of 35 mm.	2 lengths
Clamping cable of 20 mm.	20 lengths
Clamping cable of 15 mm	15 lengths
Iron sheath caps of 6 mm. in thickness intended to protect the steel wires from the cutting action of the operating edges of the dredger	12

Of the cables made use of, many sustained damage as a result of the enormous stresses to which they were subjected. There were other materials used to which, however, no reference need be made.

Cost

(a) Inventory caterial acquired expressly for the reflotation of the dredger:		
Steel and iron wire	598$00	
Clamps	1371$00	
Wiring	12277$34	
Unions, bracings and plugs	653$00	
Leather hose pipe	20460$00	
Jointures (extra)	252$00	
		35,611$34
(b) Material consumed throughout operations		18,725$72
(c) Staff and workers' allowances authorised for the purpose		44,538$60
(d) Material already to hand, utilised in the refloating operations, such as cylinders, including accessories and other material, the whole appraised at 946,918$00. 10% depreciation allowance, a percentage made chargeable to general outlays	94,691$80	
Sundry operations carried out in 1940 on cylinders in question	15,000$00	
		109,691$80
(e) Additional material of the Port of Lisbon Authority made use of in the operations		230,000$00
		438,567$46

At the conclusion of the meeting summoned to consider the salvaging of the tug *Cabo Sardão*, I mentioned the mishap to the dredger *Alcântara* and pointed out that it would be necessary to utilise much of the equipment expressly acquired to salvage the former, for the purpose of salvaging the latter.

This fresh problem was formulated and we started on its liquidation. It was solved in the manner outlined above.

If we consider that, at the present moment, the tug boat *Cabo Sardão* and the dredger *Alcântara* represent a money value of no less than 9,000 millions (of reis) and that the total outlays incurred in the salvaging and reparation both of the one and the other so as to restore them to their original operating condition, should not exceed 1,500 millions, the conclusion is inevitable that in both cases the salvaging expenditure will be amply recompensed.

Port of Dublin Facilities.

In a recent lecture to the Port of Dublin Sea Scouts Association on "The Evolution of the Port and Harbour of Dublin," Lieut.-Comdr. A. J. O'Brien-Twohig, harbour master, made the following statement as to the existing facilities at the port. At present, he said, there were nearly four miles of splendid modern quays, along which were placed numerous highly efficient electric portable cranes ranging in capacity from three to six tons and capable of hourly discharge at the rate of 35 to 40 tons per crane. Most of the quays on the north side of the river were connected by rail to the main railway system of the country, and goods could be discharged from the ships into railway wagons for dispersal throughout the whole country.

Notable Port Personalities

XXXII—Sir William Crosthwaite, J.P.

Born in 1880, **Sir William Crosthwaite,** after a Board School education and apprenticeship to a local ship chandler, sailmaker and nautical instrument maker, went to sea for a time as an ordinary seaman. Then, at the age of 26, he found himself in control

Sir WILLIAM CROSTHWAITE, J.P.

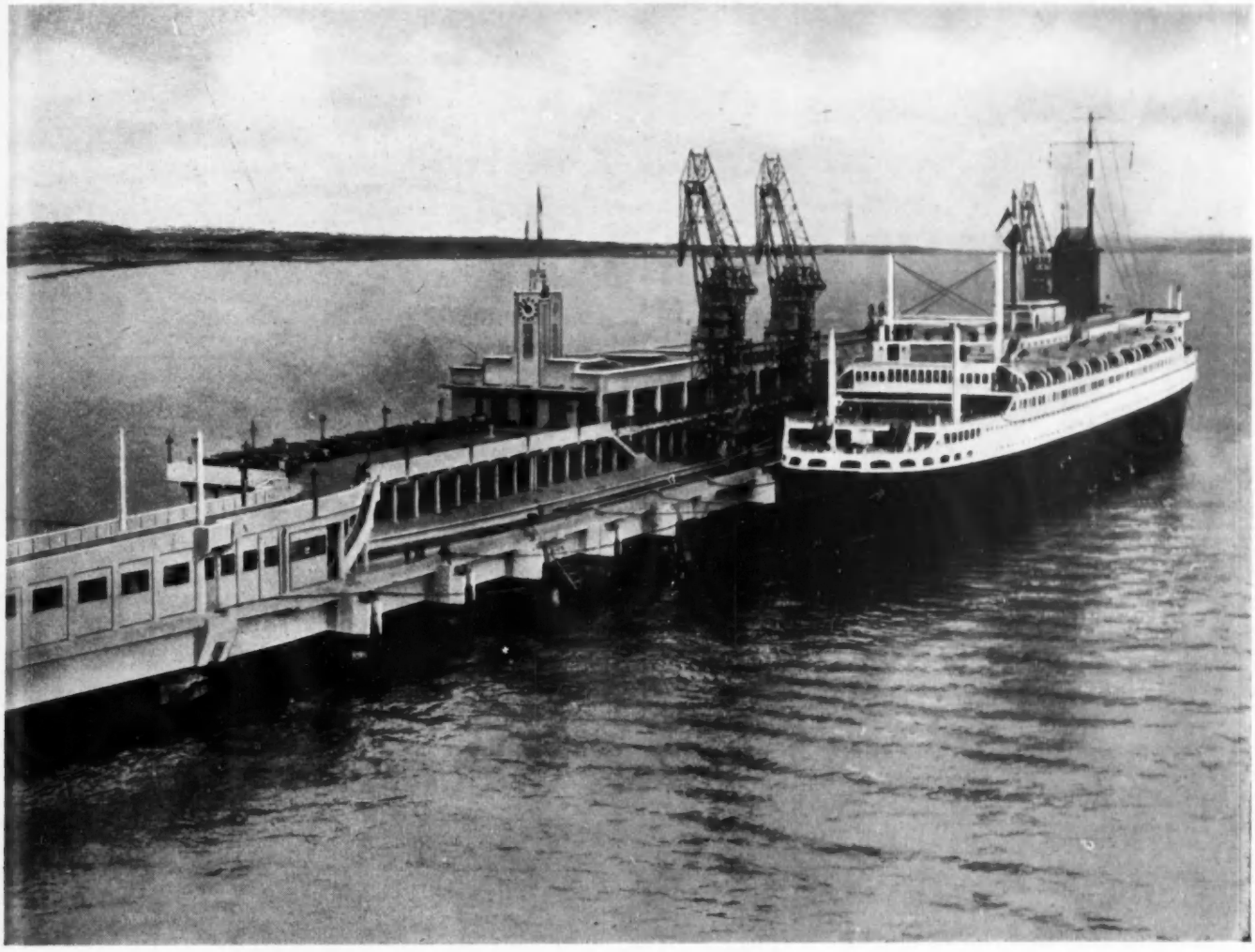
of a towage and salvage business on the Tees. This business under the style of Robinson & Crosthwaite, combined with the kindred concerns of The Tees Towing Company and Chas. Duncan & Sons, Ltd., of which Sir William is chairman, made him a leading figure in the town and port of Middlesbrough. He was the first British tug-owner to possess an electrically propelled tug: the *Acklam Cross*.

Sir William was elected a member of the Middlesbrough Town Council in 1920 and four years later became Mayor. He is now serving his fifth term of office in the mayoralty. His interest in port affairs is shown by his membership of the Tees Pilotage Board and of the Tees Port Health Authority, while, since 1930, he has been a member of the Tees Conservancy Board, recently succeeding Sir Francis Samuelson in the chairmanship. He was knighted in 1939.

Ministry of Supply Appeal for Old Rubber Fenders.

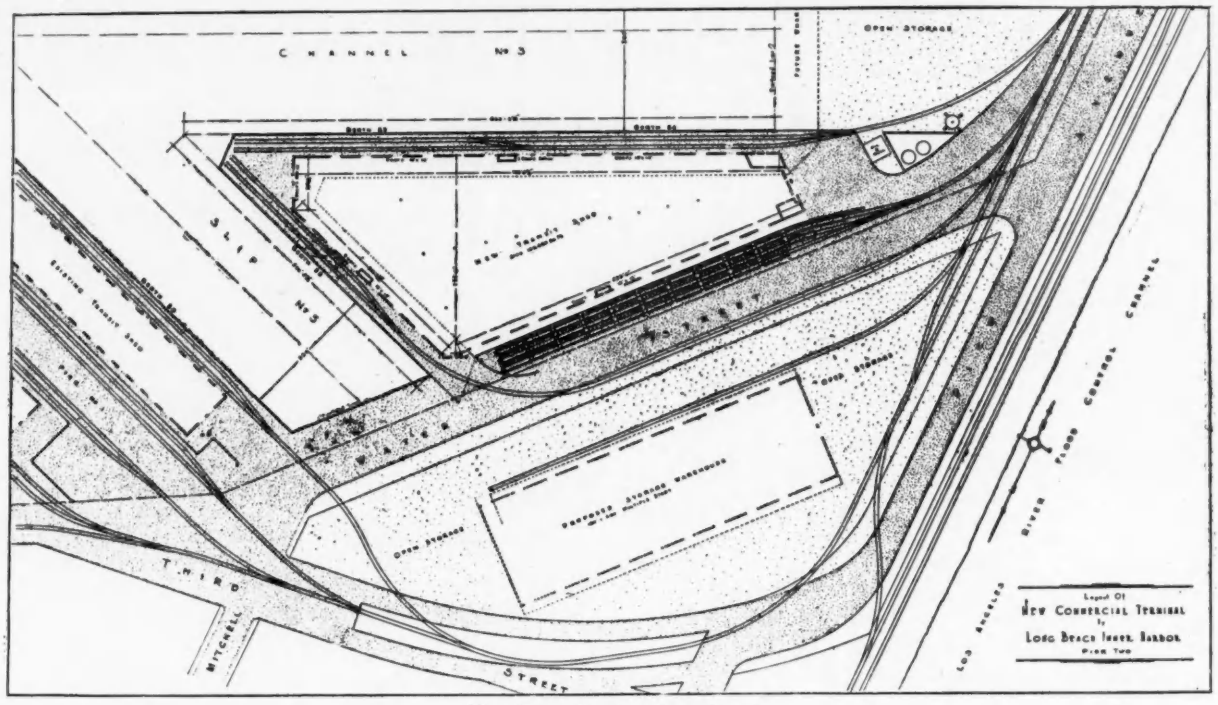
Hanging on piers and jetties and on many craft around the shores of Britain and on barges on canals is rubber that is urgently needed for the war effort. It is in the form of old tyres which are being used as fenders to take the impact of vessels against the sides of piers and jetties. Bunches of hazel twigs will serve the purpose equally well. The Ministry of Supply appeals for these old tyres for salvage so that the rubber may be reclaimed. They should be made available to the salvage officer of the nearest local authority.

REINFORCED CONCRETE IN DOCKS AND HARBOURS



Reinforced Concrete Passenger Jetty at Verdon Docks, near Bordeaux.

Reinforced concrete dock and harbour structures have a high degree of resistance to corrosion by sea water. This quality, together with the durability and enormous load carrying capacity of reinforced concrete, makes the material particularly suitable for dock and harbour work. Furthermore, the monolithic nature of reinforced concrete renders major damage by impact almost impossible. There will be many extensions and much reconstruction of docks and harbours in the post-war years and for new berths, jetties, sea walls, warehouses and sheds, as well as for the reconstruction of existing buildings, reinforced concrete will be selected as the most durable and trouble-free material.



New Cargo Service, Long Beach.

*New Cargo Terminal at Port of Long Beach, California, U.S.A.**

Novel Adaptation to Restrictive Surroundings

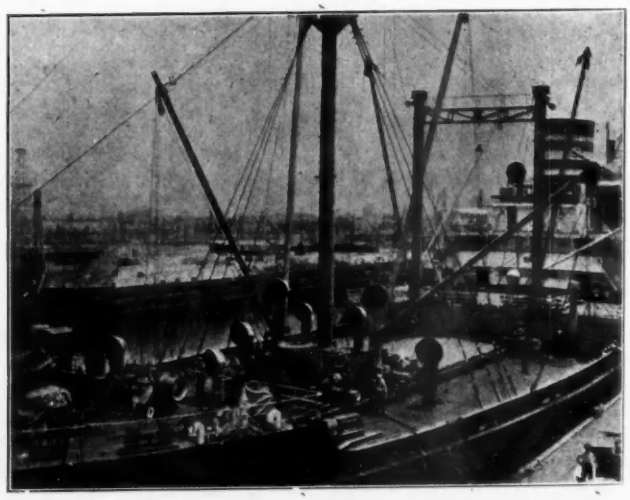
By ROBERT R. SHOEMAKER,
Chief Engineer, Long Beach Harbour Department.

THE PORT OF LONG BEACH, the public facilities of which have been very largely developed in the Outer Harbour behind the protection of the City and Federal Breakwaters, has for a number of years owned a small, irregularly shaped acreage in its Inner Harbour, ideally located for harbour development, but so restricted in its approaches that the design of a satisfactory general barge terminal seemed impracticable. With the recent acquisition of adjacent properties and the contemplated purchase of additional parcels, the site has been expanded and, with careful planning, guided by the dimensions and shape of the site, the Port has now constructed one of its most attractive terminals and one which will lend itself excellently to intensive and economical operation.

Pier 2, Berths 52, 53 and 54, as the facility is known, fronts on Channel 3 with 860-ft. of frontage and has 506-ft. of frontage on Slip No. 5. The entire frontage is now improved with a modern creosoted timber wharf. While the writer does not subscribe to the policy of constructing timber wharf decks beneath any area to be occupied by transit shed construction, wood construction became necessary in this instance by reason of the initial planning, design and contracting for an open wharf of timber design, conceived in the expectation that a transit shed could not be developed at such a restricted site. The later opportunity to obtain adjacent lands, however, plus the urgent demand for an additional shedded terminal and the fact that this site was the only one available without delay, led to the planning of the transit shed after the timber wharf construction was well advanced.

*Reproduced from "World Ports."

However, the entire marginal wharf, of which the front 33-ft. is apron wharf and the rear 32-ft. of which is located beneath the transit shed, is of heavy timber construction designed for 750 lbs. per sq. ft. live load, and with no structural timbers smaller than



View from roof of Transit Shed on Pier 1, showing Piling and Bulkhead of New Pier in background.

New Cargo Terminal at Port of Long Beach, California, U.S.A.—continued

10-in. by 18-in. The structure is thus of the extremely slow burning type and in addition is decked with 4-in. laminated creosoted decking surfaced with 3½-in. of asphaltic concrete, and provided with a modern under wharf sprinkler system and an unusually complete system of fire bulkheads extending from low water to the underside of the wharf deck. In addition, frequent covered openings are provided through the wharf deck for access from above by special fire apparatus.

Moreover, while the shed structure is partially over the wharf, it is not founded upon either timber piles or upon the wharf, but upon pre-cast reinforced concrete piles driven in clusters and capped with concrete footings. These footings and their concrete pile supports are beneath the wharf and are completely independent and free of the wharf structure and any movement of the wharf resulting either from the shock of berthing ships or from earthquakes. All footings are inter-connected with reinforced concrete ties and struts and are braced independently of the wharf with batter piles designed to take either wind load on the building structure or earthquake forces and properly distribute these forces to the ground.

A Sectional View of Long Beach's Harbour Facilities.

The pre-cast concrete piling are 16-in. square and vary in length from 46-ft. to 70-ft. They are reinforced with 8⅞-in. round vertical bars in a 9-in. square core with ¼-in. round ties throughout and closely spaced spirals at top and bottom. As the cheapest and most satisfactory protection of these concrete piles against the deteriorating action of sea water, ample protection over the reinforcing steel was provided with 3-in. of concrete clear of the steel. High strength concrete was specified and attained as the best measure of impermeability. Average test results showed 3,300 lb. concrete at 7 days with ordinary Portland cement and 4,200 lbs. at 21 days. Handling of the piles was carefully restricted to 4 and 5 point suspension in order that they might not be over-stressed in lifting or storing.

The odd shaped area was utilised best for transit shed purposes by designing a trapezoidal-shaped building some 705-ft. in maximum length and 294-ft. in maximum width. The transit shed thus fits into the increased demand of recent years on the part of terminal operators for very wide and spacious transit sheds adaptable to motorised equipment and has been arranged with only 12 interior columns in the entire building, to facilitate rapid movement of cargo. The principal trusses are 45-ft. centres and are of long span. This arrangement permits the location of water-side doors 18-ft. by 14-ft. in dimension and rear platform doors 18-ft. by 12-ft. in dimension, at 48-ft. and 45-ft. centres respectively, which is advantageous in the serving of freight cars. The area of the transit shed is 14,480 sq. ft.

The shed is served by two apron wharf tracks on the Channel 3 side, with a crossover from the inside to outside track midway between berths, and two tracks on the Slip 5 side. To the rear of the shed are located three low line tracks which accommodate 33 railroad cars. The entire loading area in the rear of the shed is paved for a total width of 100-ft.

As it is anticipated that in the long run the facility will be used very largely for Pacific coastwise trade, it is expected that there will be many deck loads of lumber. The large open storage area north and east of the wharf is for the purpose of accommodating these deck loads until such time as they can be loaded and moved without the necessity for hampering general cargo operations.

The demand for shipside storage in the Port is very great and for this reason the City is now acquiring property immediately to the rear of the transit shed for the purpose of locating a storage warehouse 150-ft. by 300-ft. to be constructed to only one-storey at first, but to be designed for a multiple storey condition later.

The plan shows clearly the ultimate layout and its availability to all street and rail services.

Review

The Mechanical Handling Year Book and Manual, 1943. Edited by Henry Pynegar. Pp. 399 + vi. With 400 illustrations in the text. Price 30s. 10d., post free. London, 1943; Paul Elek, Publishers, Ltd., Africa House, Kingsway, W.C.2.

This handy volume forms one of a series of specialist Engineering Year Books which provide recent and reliable data on various phases of engineering. In the present case, the subject matter is grouped into six sections, the first two of which relate to machine mining underground, and to main and auxiliary screening and so lie somewhat outside the province of this Journal. Section No. 3 on Conveying and Elevating plant, Section No. 4 on Industrial Trucks and Sections Nos. 5 and 6 on Cranes, mobile and general, however, contain a good deal of information on matters which concern port and dock operation.

The material generally is arranged in the form of a scrap, or note book, in which items of interest from various sources are collected and, where necessary, tabulated. In this way, it is possible to give particulars of miscellaneous installations and specialised plant made by different manufacturing firms, whose products are indexed with their respective names at the end of the volume. Combined with a number of advertisements, this enables the reader to get into touch with the individual manufacturer who can best supply his precise needs. There are also a number of detached notes relating to methods of operation. The book should prove a convenient source of reference for the practising mechanical and electrical engineer.

Hamburg Port Traffic in 1941.

The report of the Hamburger Hafen und Lagerhaus, A.-G. (Hamburg Harbour and Warehouse Company, Limited) for the year 1941 shows that the quantity of goods passing over the quays of the port was greater than in the previous year, although there was only a slight increase in the number and tonnage of ships dealt with. This is stated to be evidence of the full utilisation of the shipping space in the port. By reason of the war, there was a further decline in the quantity of goods stored in the warehouses, but the regular utilisation of the facilities for traffic and other purposes enabled business to be maintained fairly well, considering the circumstances. The financial results, however, further worsened, owing to the unsatisfactory position compared with normal peace-time conditions.

The Dock and Harbour Authorities' Association

Annual Meeting

THE ANNUAL MEETING of the Dock and Harbour Authorities' Association was held in London on February 10th, with **Sir John Irvin, K.B.E.,** retiring President, in the chair. He announced that the number of members was now 63, the largest in the history of the Association.

Address by Chairman of the Executive Committee

In proposing the adoption of the report of the executive committee for the year ended December 31st, 1942, **Colonel J. G. B. Beazley,** of the Mersey Docks and Harbour Board, chairman of the executive committee, said it had been a very important year and many matters had occupied their attention.

War Damage Act, 1941

It would be remembered, he continued, that Part I of the War Damage Act of 1941, which dealt with the payment of contributions toward war damage in respect of buildings and immovable property, did not cover public utility undertakings which included dock and harbour authorities.

Movable property of public utility undertakings was originally included in Part II of the 1941 Act and made compulsorily insurable under the business scheme, but soon after the passing of the Act the Board of Trade made an order giving public utility undertakings an option of insuring their movable property under the business scheme or not, and later suggested to the public utility undertakings that they should not insure the movable property under the business scheme because it was intended to deal with movable as well as immovable property of those undertakings by a subsequent bill.

War Damage Payments

The promised separate Bill to deal with these undertakings had not yet been introduced. A Government White Paper issued last November and circulated to the members of the Association dealt with the outline of proposals for the further legislation needed to provide for payments in respect of war damage to and contributions from these undertakings in respect of all their properties, immovable and movable, which were called in the White Paper public utility assets.

Shortly, the proposals of the White Paper were:—

1. Public utility undertakings shall be divided into nine categories: railway, canal, dock and harbour, lighthouse, gas, electricity, sewerage, sewage disposal and water.
2. The Government will pay 50 per cent. of the aggregate war damage to the public utility assets of all members in each group.
3. The remaining 50 per cent. of that aggregate war damage shall be pooled between the members of the group according to a scheme to be agreed upon between the members, or, failing agreement, to be made by the Treasury subject to the approval of the House of Commons.
4. The contributions apportioned to each member of a fifth and final instalment which will be of an adjustment nature.

The principle that 50 per cent. of all war damage shall be borne by the Government, i.e., by the taxpayers generally, and that the remaining 50 per cent. shall be pooled between all owners and lessees of property is the basis of the 1941 Act in regard to contributions for war damage, but it will be readily appreciated that if this principle, applied to a separate group of authorities owing a particular class of property which has been specially sought out for air attack, the burden of war damage falling on those owners is, in proportion to the capital value of their properties, much higher than that falling on owners generally of properties not so heavily attacked by the enemy.

Accordingly the Parliamentary and General Matters Sub-Committee had had meetings with officials of the Treasury and of the Ministry of War Transport and had pointed out that a contribution by dock and harbour authorities upon the basis of 50 per cent. of the total war damage sustained by the docks and harbours in the United Kingdom would put these authorities relatively in a much worse position in relation to contributions to war damage than other public utility undertakings as those properties had not been singled out by the enemy for attack, and also in a much worse position than the general property owners of the country.

The Association, continued Colonel Beazley, were unanimously of the opinion that 50 per cent. was far too high.

It was true that it was recognised in the White Paper that where the incidence of damage was high, the fraction of 50 per cent. might be excessive, and the War Damage Commission might, before the final instalment of the contribution became due, take into consideration whether this fraction should be reduced and might make a report to the Treasury stating if they thought that it should be reduced what lesser fraction should in their opinion be fixed.

Any reports so made to the Treasury would have to be laid before the House of Commons and a power would be conferred upon the Treasury to make an order reducing the fraction, but this order would require the affirmative resolution of the House of Commons to bring it into effect.

This procedure, said Colonel Beazley, appeared to them to be unnecessarily complicated and, moreover, left entirely uncertain what would be the total amount of the war damage which ultimately would fall on the dock and harbour authorities themselves.

The procedure also left these authorities under the necessity of making some contribution in the near future. The sub-committee with the approval of the executive committee had consulted Sir Alan Rae Smith, of Messrs. Deloitte Plender and Co., the well-known firm of accountants, who had given them great assistance.

The sub-committee had also kept the executive committee fully informed about this difficult matter, and it had been decided to ask the Association's Parliamentary chairman to make representations on the question of the 50 per cent. contribution when the Bill came up for Second Reading, and later they would ask for a deputation to be received by the Chancellor of the Exchequer.

Reorganisation Proposals

Colonel Beazley said he expected that everyone knew that many Government officials and other persons were engaged in formulating certain schemes for the reorganisation after the war of many forms of activity, including schemes for reconstituting county and local authorities and most classes of public utility undertakers.

It would also be well known that those persons were advocating that all public utility services should be carried on by a few large corporate bodies of the nature of trusts or by a single corporate body for the whole country, and in connection therewith that reference had been made to the constitution and powers of the B.B.C., the Central Electricity Board, and the London Passenger Transport Board.

They had also been informed that schemes for the reconstitution of dock and harbour authorities were under consideration by some of the officials at the Ministry of War Transport. About a year ago a suggestion was made from the Ministry to the Association, but unofficially, that the Association should in their own interest consider and send to the Ministry a scheme for post-war organisation of dock and harbour authorities.

The Parliamentary and General Matters Sub-Committee had therefore at the request of the executive committee been giving great time and thought to this problem and had held many meetings on the subject. The problem had also been considered by the executive committee at several meetings. The matter was not however, sufficiently advanced for the executive committee to put any proposals before its members now nor could they usefully say anything more on the subject at present, but of course before any decision could be reached or any scheme of reorganisation was sent to the Ministry the members of the Association would be consulted. It might be necessary to convene a special meeting of the Association at a later date to consider this problem.

Dock and Harbour Authorities' Association—continued

Explosions Agreement

After protracted negotiations, said Colonel Beazley, they had been able to come to an agreement with the Treasury through the Ministry of War Transport on the form of indemnity by the Government to cover damage to their property caused by the explosion or ignition of explosives or petroleum spirit while in the area of the dock or harbour authority. Explosive bye-laws which were very strictly adhered to in peace-time had to be relaxed in present circumstances to avoid delay, and it was satisfactory that they should be indemnified for accident which an adherence to the bye-laws would have prevented. Members had received the form of indemnity by circular last December.

In calling upon Alderman A. W. S. Burgess, of Bristol, to second the resolution, **Sir John Irvin** said the Association were fortunate in having Colonel Beazley as chairman of their executive committee, and they heartiy thanked him for the work which the executive committee had done under his chairmanship. Members would see that the sub-committees had met 12 times during the year, and Sir John thought there had never been a year previously when the sub-committees had had so much to do. They were very fortunate in having Sir Douglas Ritchie as chairman of the Parliamentary and General Matters Sub-Committee. He had rendered great service to the Association in that capacity.

The Association had a great task before them in the coming year. It was all very well saying that the War Damage Scheme was a most unreasonable proposal. He believed, however, that if they hammered away at it they would be listened to, but when something had been incorporated in a Bill it was difficult to get it removed.

Alderman Burgess seconded the adoption of the report, and the resolution was carried unanimously.

The **Right Hon. Thomas Wiles** proposed the adoption of the accounts. He said that dock and harbour authorities would have to prepare themselves for a new era, and their difficulties after the war were going to be very great. He emphasised the necessity of preparing a scheme for post-war organisation. This would save them from having a cast-iron scheme prepared by civil servants put before them.

He felt mostly strongly that the dock and harbour authorities should be unanimous in whatever scheme they put forward and then he was confident, after the war was over, they would, having worked together, be in a far stronger position than if they had worked separately.

Councillor R. Mack, of Portsmouth, in seconding the adoption of the accounts, supported the action which had been taken by the committee.

Election of New Officers

On the motion of Sir John Irvin, seconded by Mr. Harry Parsons, of Southampton, **Sir Frederick J. West** was elected president of the Association.

Sir Alfred Read also supported the motion and paid tribute to Sir Frederick's great qualities which admirably fitted him for the duties he would be called upon to perform

Sir Frederick West then took the chair and returned thanks for his appointment.

On the proposal of Sir Frank Nicholson (River Wear Commission), seconded by Sir Arthur Allen-Williams, of Littlehampton, the four retiring vice-presidents, Lord Ritchie, Sir Ernest Herdman, Sir Alfred Read, and Sir Arthur Sutherland were re-elected together with Sir Thomas Brocklebank, Bart., chairman of the Mersey Docks and Harbour Board, and Alderman A. W. S. Burgess, chairman of the Port of Bristol Authority.

Mr. Clement Davies, K.C., M.P., was re-elected Parliamentary chairman on the motion of Sir Thomas Brocklebank, seconded by Mr. Leslie Roberts, of Manchester.

The Executive Committee, on the proposal of Sir William Crosthwaite (Tees Conservancy Commission), seconded by Alderman C. R. Woodhams (Ramsgate) was chosen as follows:—

Mr. J. K. McKendrick (North-East Coast of England).
Alderman B. O. Davies (East Coast of England).
Mr. L. H. Bolton (London District).
Mr. Harry Parsons (South Coast of England).
Mr. R. H. Jones, O.B.E. (Bristol Channel).
Sir Thos. A. L. Brocklebank, Bart. (Liverpool and N.W. District).
Mr. Leslie Roberts, C.B.E. (Manchester Ship Canal).
Mr. William Cuthbert (West Coast of Scotland).
Mr. Hugh Rose (East Coast of Scotland).
Mr. M. J. Watkins, C.B.E. (Northern Ireland).

REPORT OF THE EXECUTIVE COMMITTEE FOR THE YEAR ENDED 31st DECEMBER, 1942

The Committee present the Twenty-third Report of the Proceedings of the Association.

Meetings

The last Annual Meeting was held at the Adelphi Hotel, Liverpool, on Wednesday, 26th February, 1941.

Members agreed that no Annual Meeting should be held in 1942, and also gave their approval to the formal resolutions which comprise the principal business of such a Meeting, through the medium of the post, early in the year.

The Executive Committee have met three times and Sub- Committees 12 times during the year.

There have, as usual, been a number of meetings with Government Departments and other bodies.

Eighteen circulars on various matters have been issued to Members.

The Committee are again submitting their Annual Report in the abbreviated form adopted in 1941.

Obituary

The Committee record with great regret the under-mentioned deaths during the year:

Mr. B. L. Nairn, late Chairman of the Dundee Harbour Trust, a Member of the Executive Commitee from 1921-23, and in 1931 and 1932; and President of the Association in 1930;

Mr. J. E. Dawson, late Chairman of the River Wear Commission and President of the Association in 1931;

Mr. John A. Lindsay, Chairman, Leith Dock Commission, and Member of the Executive Committee since 1940;

Colonel J. H. Collett, Chairman of the Port of Gloucester Authority;

Mr. J. Hannay-Thomson, late General Manager, Dundee Harbour Trust, and Member of the Association's Pilotage Sub-Committee;

Mr. F. T. Nattrass, General Manager and Clerk of the Tees Conservancy Commission.

Executive Committee

The Committee again appointed Colonel J. G. B. Beazley (Mersey Docks and Harbour Board) as their Chairman.

Sub-Committees

A list of Sub-Committees for 1942-43 is set out in last year's Report.

During the year the Committee added Mr. J. K. McKendrick (Secretary, Tyne Improvement Commission) to the Parliamentary and General Matters Sub-Committee.

Members

The Exmouth Dock Company joined the Association during the year, making the number of Members 62.

A list of the names of Members is set out at the end of this Report.

List of Matters Dealt With—

Agriculture (Miscellaneous Provisions) Bill.
Allocation of Coal Supplies—Rationing (Cir. No. 551).
A.R.P. Uniforms—Dock Authorities (Cir. No. 550).
Arrangements with the Government, 1920, for payment of dues on ships and goods:—
(a) Dues on ships carrying mixed cargoes (Cir. No. 546).
(b) Cased petrol shipped for Government dues on ship and cargo (Cir. No. 543).

Dock and Harbour Authorities' Association—continued

(c) Charges on troops' baggage.
(d) Extension of the Arrangement to Dominion and Colonial Governments.
(e) Application of Arrangement to U.S.A. and other Allied Governments (Cir. No. 552).
(f) Tankers moored within the limits of a Port not a naval establishment under proviso to Clauses 2 (a) and 2 (b) (Cir. No. 552).
(g) Basic dock dues on ammunition.
(h) Set-off of dues in consideration of construction of works by Government—Clause 4 of Arrangement.
(i) Rebate in cranage charges on Government cargoes.
(j) Application of Arrangement to Salvage vessels.
(k) U.S.A. Army Mail—Exemption.
(l) Trinity House vessels.
(m) Goods not remaining in continuous Government ownership— no rebate.

Canteens in Dock industry.
Chartered and other bodies (Temporary Provisions) Act, 1939—postponement of elections.
Civil Defence Staff College—nomination for courses.
Compensation for war injuries—Civil Defence Volunteers.
Consumer Rationing Order, 1941—Questions arising.
Control of Wreck Order (S.R. & O. 1941, No. 1315).
Defence (Companies) Regulations—Transfer deeds for salvage purposes.
Discharge of Explosives and Petroleum Spirit—Indemnity (Cir. No. 558).
Docks and Harbours—Post-War Organisation.
Dock and Harbour Authorities—Wages of Maintenance men.
Dues on charitable goods.
Economy in Printing.
Emergency Works constructed on dock estates by or for a Government Department—expense of reinstatement.
Essential Works (General Provisions) No. 2 Order, 1942.
Estimates of Docks works after the war (Cir. No. 556).
Factories—Chief Inspector's Report.
Fatal Accident—Liability of Dock Authority.
Fresh Water for Curacao.
Government requisitioning of Harbour Authorities' property.
Government Traffic (Dock Charges) Committee.
Graving Docks leased by harbour authorities—rate of deduction.
Home Guard—Compulsory enrolment. Arrangements for consultation with employers (Cir. No. 547).
Income Tax—Depreciation on harbour craft.
Infestation Order, 1941.
Measurement of Deck Cargo spaces—U.S.A. Vessels.
Navigation Marks—notice of alteration.
Pilferage at Docks (Cir. No. 554)
Protected Places—Grants:
(a) Permit system and fencing.
(b) Additional Police.

Publication of Accounts of Public Utility Undertakings (Cir. No. 545).
Railway Companies (Thos. Cook & Son, Ltd., Guarantee) Bill.
Raising enemy aircraft—expenses.
Rating and Valuation—Graving Docks.
Requisitioning of Goods damaged by enemy action.
Safety of Seamen in Ports.
Schedule of Reserved occupations:
(a) Deferment
(b) Raising of age of reservation of dock and canal police.

Sports Requisites
Treatment and disposal of foodstuffs contaminated by poison gas.
War Damage—Public Utility Undertakings:
(a) War Damage Act, 1941 (Cir. No. 540).
(b) Proposed legislation for Public Utility Undertakings—Government White Paper (Cir. No. 557).

Accounts

The expenditure charged to the year's accounts amounts to £2,396 7s. 0d., of which £2,392 12s. 6d. is payable by Members; the excess of income over expenditure amounts to £19 5s. 4d.

The Report is signed by the chairman (Col. Beazley) and by the secretary (Mr. Ashley Cummins).

List of Members for 1943.

1. Aberdeen Harbour Commission.
2. Aire and Calder Navigation.
3. Ardrossan Harbour Company.
4. Bangor (Co. Down) Authority.
5. Belfast Harbour Commission.
6. Berwick Harbour Commission.
7. Bideford Corporation.
8. Blyth Harbour Commission.
9. Boston Corporation.
10. Bristol Authority, Port of
11. Cattewater Commission
12. Clyde Navigation Trust
13. Clyde Pilotage Authority.
14. Cowes Harbour Commission.
15. Dartmouth Harbour Commission.
16. Dover Harbour Board.
17. Dublin Ports and Docks Board.
18. Dundee Harbour Trust.
19. Exmouth Dock Company.
20. Forth Conservancy Board.
21. Fraserburgh Harbour Commission.
22. Gloucester Authority, Port of.
23. Grand Union Canal Company.
24. Granton Harbour, Limited.
25. Great Yarmouth Port and Haven Commission.
26. Greenock Harbour Trust.
27. Hartlepool Port and Harbour Commission.
28. Harwich Harbour Conservancy Board.
29. Inverness Harbour Trust.
30. Ipswich Authority, Port of.
31. King's Lynn Conservancy Board.
32. King's Lynn Docks and Railway Company.
33. Lancaster Port Commission.
34. Larne Harbour, Limited.
35. Leith Dock Commission.
36. Limerick Harbour Commission.
37. Littlehampton Harbour Board.
38. Llanelly Harbour Trust.
39. London Authority, Port of.
40 Londonderry Port and Harbour Commission.
41. Manchester Ship Canal Company.
42. Medway Conservancy Board.
43. Mersey Docks and Harbour Board.
44. Milford Docks Company.
45. Newlyn Pier and Harbour Commission.
46. Newport Harbour Commission.
47. Penzance Corporation.
48. Poole Harbour Commission.
49. Portsmouth, City of.
50. Preston Authority, Port of.
51. Ramsgate, Port of.
52. Sandwich Port and Haven Commission.
53. Scarborough Harbour Commission.
54. Seaham Harbour Dock Company
55. Shoreham Harbour Trust.
56. Southampton Harbour Board.
57. Tees Conservancy Commission.
58. Tyne Improvement Commission.
59. Warkworth Harbour Commission.
60. Wear Commission, River.
61. Whitehaven Harbour Commission.
62. Workington Harbour and Dock Board.

Honorary Members

Harbours Association of New Zealand.
Bombay Port Trust.
Interstate Conference of Australian Harbour Authorities .

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